NOTE

This Microfiche meets the quality requirements of the American National Standard for Microfiche of Documents (ANSI PH5.9-1975). However, because of imperfections in the document from which it was made, it contains images that are illegible or difficult to read. The source document for this microfiche is the best copy that could be obtained prior to filming.

CIS

Office of Technology Assessment

Congressional Board of the 99th Congress

TED STEVENS, *Alaska, Chairman*

MORRIS K. UDALL, *Arizona, Vice Chairman*

Senate

ORRIN G. HATCH
Utah

CHARLES McC. MATHIAS, JR.
Maryland

EDWARD M. KENNEDY
Massachusetts

ERNEST F. HOLLINGS
South Carolina

CLAIBORNE PELL
Rhode Island

House

GEORGE E. BROWN, JR.
California

JOHN D. DINGELL
Michigan

CLARENCE E. MILLER
Ohio

COOPER EVANS
Iowa

DON SUNDQUIST
Tennessee

JOHN H. GIBBONS
(Nonvoting)

Advisory Council

WILLIAM J. PERRY, *Chairman*
H&Q Technology Partners

DAVID S. POTTER, *Vice Chairman*
General Motors Corp. (Ret.)

EARL BEISTLINE
Consultant

CHARLES A. BOWSHER
General Accounting Office

CLAIRE T. DEDRICK
California Land Commission

JAMES C. FLETCHER
University of Pittsburgh

S. DAVID FREEMAN
Lower Colorado River Authority

GILBERT GUDE
Library of Congress

MICHEL T. HALBOUTY
Michel T. Halbouty Energy Co.

CARL N. HODGES
University of Arizona

RACHEL McCULLOCH
University of Wisconsin

LEWIS THOMAS
Memorial Sloan-Kettering Cancer Center

Director

JOHN H. GIBBONS

annual report

To the Congress

Fiscal Year 1985

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

J952-22

Contents

Section *Page*
I. Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA 1
II. Year in Review 7
III. Work in Progress 45
IV. Organization and Operations 47

Appendix
A. Technology Assessment Advisory Council 57
B. List of Advisors and Panel Members 60
C. Technology Assessment Act 116

Section I.—Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA

Chairman's Statement—
Senator Ted Stevens

The passage of the Balanced Budget Act of 1985 has intensified the pressure for Congress to carefully review all authorizations and appropriations to ensure that programs are necessary and represent a good investment of Federal dollars. It is particularly important that Congress have prompt access to unbiased and clear information about the longer term consequences of scientific and technological issues, lest these considerations get lost in the drive to cut budgets. The assessment reports, technical memoranda, and other information that OTA provided to committees included valuable information and analyses that Congress needs to meet its responsibilities in matters involving science and technology.

Committees of both the House of Representatives and the Senate take advantage of the resources offered by OTA. Last year, OTA reports covered topics ranging from toxic wastes and groundwater contamination to the changing structure of American agriculture to U.S. vulnerability to loss of imported strategic materials.

In addition to formal assessment reports, OTA provided Congress with less formal but timely information on smoking-related deaths and their financial costs, and a review of the Public Health Service's response to the problem posed by AIDS. The OTA paper on smoking reviews previous estimates of the extent of smoking-related diseases and provides new estimates of the number of deaths due to smoking. It also contains estimates of the financial costs associated with treating smoking-related diseases. The AIDS study reviewed the recent and proposed activities of the Public Health Service (PHS) in response to AIDS and provided a description of the scientific and clinical status of AIDS. It focuses on the planning efforts, resources, and staffing of PHS's efforts to understand and control AIDS. These are just two examples of OTA's emphasis on being responsive to urgent congressional concerns.

Vice Chairman's Statement—Congressman Morris K. Udall

Over the past several years, there has been a steady increase both in the number of committees served by OTA and in requests for full assessments, short responses, and special analyses. When experts disagree on, for example, the technical or economic impacts of a new technology, the process of public policymaking becomes particularly confusing. OTA has provided a unique, in-house, nonpartisan service to Congress, helping congressional committees resolve uncertainties and conflicting claims.

OTA's record of accomplishments demonstrates its ability to aid Congress in developing broad policy options. I will cite only four of many.

(1) This past year OTA released a comprehensive study on prevention of costly, difficult cleanups under the Federal Superfund program. Although debate centered on how much money to spend on the Superfund program, the OTA study emphasized the importance of focusing more attention on how to spend the money and how fast.

(2) The OTA report on solving Africa's food problems concluded that the greatest potential for significantly expanding Africa's food production lies in increasing the productivity of small, subsistence-level farmers and herders, who raise most of Africa's food and yet have been largely ignored. Food producers need technologies that are low risk, require low purchased input, are based on existing agricultural methods, and are suitable for the small farms, small businesses, and small incomes in Africa. The challenge is to devise research, extension, and aid programs that involve local people and integrate on-farm work into the larger framework of national and international efforts.

(3) OTA also looked into the problems facing America's elderly. The report concluded that effective use of both "low-tech" and "high-tech" can help more older Americans live independently. A variety of technologies can improve the health and functional ability of older persons, and possibly reduce health care expenditures.

(4) OTA's analyses of ballistic missile defense and anti-satellite weapons were used extensively by both sides of the debate last year. These studies contributed to a much better understanding in Congress, the press, and the public of the stakes and issues in those areas.

In carrying out its constitutional responsibilities, Congress must be capable of independent, expert appraisal of government programs and policies. This task becomes more challenging as budget pressures rise and as technological issues mount. That's why OTA is such a special resource in these times.

TAAC Chairman's Statement—
William Perry

The Technology Assessment Advisory Council remains impressed by the relevance of the subjects OTA is undertaking and by the quality of the analyses. This year TAAC examined OTA's work on industrial waste, employment, international commerce, defense, oceans and environment, and biological applications. We took special note of several studies with important implications for the future:

- OTA, building on their previous work on technologies for cleanup of past hazardous waste dumps, is now addressing the critical issue of reduction of new sources of hazardous waste. Over the long run, prevention should have the biggest impact on our hazardous waste problem.
- OTA's study of reemploying displaced adult workers raises interesting and important issues. TAAC was particularly concerned about: 1) the potential for remedial education using advanced technology; and 2) the implications of wasted urban infrastructure when jobs leave regions.
- The assessment on technology transfer to the People's Republic of China should provide much useful information at a time when the Chinese are anxious to profit from all sources of new ideas and are experimenting with profit-induced enterprise and a move toward a market economy. OTA has the delicate task of laying out the technical issues, while neither dwelling on nor obscuring the many political ones.
- OTA's project on ballistic missile defense has provided a comprehensive and objective analysis of the subject and has made an important contribution to the public policy debate. This issue concerns substantial frontier technologies and will likely need continuing analysis.
- OTA's work on acid rain and other environmental issues will continue to be important to broad national concerns since OTA has the capability to integrate a variety of issues that have been fragmented for political and jurisdictional reasons.
- OTA's work on frontier areas of biological applications (biotechnology, neuroscience, genetics) is a good example of the agency's increasing skill in integrating the social, ethical, and legal implications of various fast-moving technologies into its studies.

We believe that OTA's methods for ensuring the accuracy and objectivity of their studies continue to produce effective results.

Director's Statement—John H. Gibbons

One piece of advice I received recently from a distinguished colleague from outside government was that it would be better for OTA if we could steer clear of highly controversial issues—our life would be more simple and enjoyable, and we could do better analyses because of fewer pressures of politics, special interests, and time deadlines. It was a tempting thought! But one of the central reasons Congress created OTA was to help committees wrestle with highly complex and controversial technical issues. A frequent assignment is to tackle issues so charged that only first-rate, objective analysis by an organization that neither gains nor loses from the outcome will hold up under the kind of scrutiny and political comment that will be given to it.

In this annual report we summarize the analyses delivered to Congress during the year and give examples of their legislative use. We also provide brief descriptions of work in progress as the fiscal year ended. I hope the reader will spend a little time on these summaries, because they collectively provide a glimpse into the extraordinary technical complexity that now characterizes governance. Some of the subjects undertaken by OTA are more controversial than others, but all deal with expensive and important technical issues faced by Congress.

Congress created OTA because of widespread feeling that committees need continuing help in monitoring emerging developments in science and technology with respect to opportunities and impacts on the future of the country. For instance, there is a possibility of using sophisticated tests to determine whether a particular person is more, or less, susceptible to genetic mutations from exposure to a given substance or workplace hazard. Can such tests be made highly reliable? Does the genetic makeup of individuals differ that much? What are the implications for equity and opportunity in the workplace? During the year OTA undertook this and other analyses to try to sort out various views and provide Congress with a well-reasoned sense of the implications.

Because of OTA's responsibility to keep abreast of emerging science and technology issues, it is especially important that OTA's analysts see the world as it is, and also think about what it might become. Provincialism is an ancient disease that can blind people as seriously as the actual loss of eyesight. That means OTA must be meaningfully linked to people and places outside Washington. It's not that links within Washington aren't also essential—they are. But wisdom about the frontiers of science and technology and their implications is *not* centered in the Nation's capital, and not always within the United States.

There are several ways OTA works to stay broadly connected to the national and increasingly international network of expertise on technology. First, we go into the field and meet with top experts and important stakeholders from the public and private sectors on any given issue. Second, we ask them to come to OTA and advise us—as advisory panel members, consultants, workshop participants. Third, we ask them to read and critique our draft material, to assure accuracy, completeness, objectivity, fairness to the stakeholder positions we describe, and to spot and weed out political bias. This process has worked well for OTA because: 1) people we call on for help know that OTA will take them very seriously and will try to be responsive to what they say; and 2) they also believe that Congress will take the results of OTA's analyses seriously. During the year OTA received substantive input from over 1,500 different individuals from outside government—an important feature of the procedures we use to pursue quality, completeness, and usefulness of our reports to Congress.

Over the next several years the U.S. Congress will be debating intensively the questions of how to equitably provide desired public services at minimum cost. OTA staff, with its analytical skills and nonpartisan approach, and guided in the choice of its work by its bipartisan, bicameral Technology Assessment Board, can be an important resource to Congress in understanding the hard choices that assuredly lie ahead.

Section II.—Year in Review

The assessments carried out by OTA cover a wide spectrum of major issues that Congress and the country are facing. A brief summary of each report published by the Office during the year* is presented in this section. The reader is cautioned that these are synopses of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.

Ballistic Missile Defense Technologies

President Reagan's Strategic Defense Initiative (SDI) proposes intensive research on technologies such as lasers, particle beams, electromagnetic railguns, and new types of sensors—some of which might lead to highly effective space-based defenses.

Ballistic Missile
Defense Technologies

This report describes the controversies over what requirements such technologies would have to meet, describes the present state and future potential of the most relevant technologies, and offers policy options both for current research and future deployment.

Several general findings carry implications for the choices Congress faces in approving BMD research:

1. If the Soviets are determined to maintain the ability to destroy many U.S. cities, BMD cannot assure the survival of all or nearly all the U.S. population in an all-out nuclear attack. But BMD combined with agreed strict limitations on the quantity and quality of offensive forces might lead to a high level of assured survival.
2. A BMD system that could protect a substantial fraction of U.S. land-based intercontinental ballistic missiles (ICBMs) and possibly of the strategic command and control system against a Soviet first strike could be built with available technology.
3. How effective an affordable BMD system could be is impossible to say at this time.
4. The decision whether to push ahead vigorously with the SDI or to scale back the Administration proposal involves a balancing of opportunities against risks, in the face of considerable uncertainty.

---

*Fiscal year 1985 (October 1984 through September 1985).

The SDI offers an opportunity to substantially increase our nation's safety *if* we obtain great technical success *and* a substantial degree of Soviet cooperation.

The SDI carries a risk that a vigorous BMD research program could bring on an offensive and defensive arms race, and a further risk that BMD deployment, if it took place without Soviet cooperation, could create severe strategic instabilities. At issue is how a vigorous U.S. program to develop BMD will affect Soviet willingness to agree to deep reductions of strategic offensive forces on terms acceptable to the United States.

5. It would be prudent to organize any U.S. BMD research program so as to minimize Soviet incentives to break out of the ABM Treaty before the United States is ready to make its own decision about BMD deployment.

OTA has indentified a range of approaches to BMD research. These are:

1. SDI approach: Vigorously investigate advanced BMD technologies with the intent to decide in the 1990s on whether or not to enter full-scale engineering development and subsequent deployment.
2. Early or intermediate deployment approaches:
    a. emphasize early and incremental deployment of currently available BMD technology; or
    b. emphasize research on BMD technologies advanced beyond those available today but which, unlike many SDI technologies, might be applicable to deployments in the early to mid-1990s.
3. Research approaches with no commitment to a deployment decision in the foreseeable future:
    a. investigate ~~advanced~~ BMD technologies at a funding level well below that requested for the SDI and with a much reduced sense of urgency, though with similar long-run technological goals; or
    b. balance research in advanced BMD technologies with the development of near-term deployment options which would include "traditional" BMD technologies (ground-based, nuclear-armed, radar-guided interceptors).

The report examines technologies and ideas which suggest possibilities for a variety of sensors and destructive mechanisms for tracking and attacking ballistic missiles throughout their trajectories: in the boost phase when the missile is gathering speed; in the post-boost phase when the warhead-bearing reentry vehicles (RVs) are separating from the upper stage of the rocket; in the midcourse as the RVs coast through space; and in the reentry phase as the RVs come into the atmosphere. The report discusses the current state of these technologies and ideas and what further developments will be needed if they are to be incorporated into workable, affordable weapon systems.

The subject of anti-satellite weapons is dealt with in a companion report, *Anti-Satellite Weapons, Countermeasures, and Arms Control.*

Anti-Satellite Weapons, Countermeasures, and Arms Control

A combination of arms control and technical improvements in satellite survivability may make the greatest contribution to safeguarding valuable U.S. satellites. However, anti-satellite (ASAT) arms control provisions could reduce the ability of the United States to respond to threatening Soviet satellites and could slow the pace of the current Strategic Defense Initiative program.

Anti-Satellite Weapons,
Countermeasures, and
Arms Control

Current U.S. policy towards ASAT arms control is the product of three concerns:

1. *The Desire to Protect U.S. Satellites.* The United States is becoming more dependent on military satellites. New technologies will soon enable satellites to supply more types of information, more rapidly, to more diverse locations, and to operate as components of weapon systems.

The U.S. ASAT weapon program is intended, in part, to deter Soviet attack on valuable U.S. satellites by threatening retaliation in kind. However, the United States, with its global security commitments and force deployments, depends more on satellites to perform important military functions than does the Soviet Union. Therefore, the Soviets may be willing to accept the loss of some of their satellites in exchange for the destruction of more valuable U.S. satellites.

Whether or not advanced ASAT weapons are developed, the United States could take a variety of unilateral defensive measures to protect its satellites. Passive countermeasures—such as evasion, hardening, and proliferation—all offer significant protection against the current and some future Soviet ASAT weapons. Active countermeasures such as electronic jamming could also be effective.

2. *The Threat Posed by Soviet Satellites.* Although current Soviet military satellites pose only a limited threat to U.S. military capabilities, future Soviet satellites capable of carrying out advanced target acquisition and tracking functions will pose a greater threat. The U.S. ASAT weapon, when operational, would be able to destroy many of the satellites that the Soviets might rely on in a terrestrial conflict.

The United States would not always have to destroy Soviet satellites to neutralize the threat they pose. Countermeasures such as "jamming" (overloading enemy receivers) or "spoofing" (sending deceptive signals) could be effective in some instances.

3. *The Relationship Between ASAT Arms Control and BMD.* ASAT and ballistic missile defense (BMD) technologies overlap, but BMD plays a potentially more important role in the U.S./Soviet strategic relationship. If the United States wishes to maintain a rapid pace of BMD re-

search, it should avoid most types of negotiated ASAT limitations. Conversely, if the United States wishes to slow the pace of Soviet BMD research and is willing to defer the testing of space-based or space-directed weapons, an ASAT treaty could contribute to that result. In either case, it is the U.S. position on space-based BMD that will determine its position on ASAT, not vice versa.

The Balance Between Arms Control and Technology Development

OTA considered the pros and cons of seven different combinations of arms control and ASAT weapon development. In addition to the developments described, the United States would likely pursue some of the passive or active countermeasures allowed in each regime:

1. *Existing Constraints.* Existing treaties prohibit attacks on satellites except in self-defense, testing or deploying space-based weapons with BMD capabilities, and detonating or deploying nuclear weapons in space. All other ASAT weapon development and deployment activities are allowed.

2. *Comprehensive ASAT and Space-Based Weapon Ban.* The United States and the Soviet Union would forgo the possession of specialized ASAT weapons, the testing—on Earth or in space—of specialized ASAT capabilities, the testing in the "ASAT mode" of systems with inherent ASAT capabilities, and the deployment—in space—of any weapon.

3. *ASAT Test Ban and Space-Based Weapon Deployment Ban.* The United States and the Soviet Union would agree to forgo all testing in an "ASAT mode" (i.e., the testing of ground-, air-, sea-, or space-based systems against targets in space or against points in space) and the deployment of any weapon in space.

4. *One Each/No New Types.* The United States and the Soviet Union would retain their current ASATs but halt the testing and deployment of more advanced systems.

5. *Rules of the Road for Space.* Rules would either serve the general purpose of reducing suspicion and encouraging the orderly use of space, or specifically aid in the defense of space assets. General rules might include new, more stringent requirements for advance notice of launch activity. Specific rules might include agreed upon and possibly defended "keep-out" zones around important space assets.

6. *Space Sanctuary.* Altitude limits would be set above which military satellites could operate, but testing or deploying weapons would be forbidden.

7. *Space-Based BMD.* Since a modest BMD system would make a very capable ASAT weapon, in a "space-based BMD" regime there would be no attempt to restrain ASAT development. Moreover, each side would probably want the freedom to develop new "ASAT-type" weapons capable of destroying the opponent's space-based BMD systems.

The subject of ballistic missile defense is dealt with in a companion report, *Ballistic Missile Defense Technologies.*

New Electric Power Technologies

In the face of highly uncertain demand growth, and increasingly complex financial and regulatory considerations, electric utilities are now taking steps to increase their flexibility in planning for adequate electricity supply. The steps include environmental and efficiency improvements to conventional power generation, life extension of existing powerplants, and purchase of power from other sources.

NEW
ELECTRIC
POWER
TECHNOLOGIES

Problems and Prospects
for the 1990s

In addition, there is growing interest in a number of technologies that have not traditionally been used by utilities or other power producers. These technologies can offer increased flexibility to meet a significant fraction of demand growth beyond the year 2000. They can be constructed in modular units that permit capacity additions to be made in small increments, with less concentration of financial assets and shorter lead-times between commitment and coming "on-line." In addition, many can increase the clean and efficient use of abundant domestic energy resources. These technologies include: atmospheric fluidized-bed combustion (AFBC), integrated coal gasification/combined-cycle (IGCC), fuel cells, geothermal, wind, photovoltaics, solar thermal, compressed air energy storage (CAES), battery storage, and load management.

At the current rate of development, however, these technologies are not likely to be able to contribute significantly to U.S. electricity supply in the 1990s. For the AFBC, IGCC, and CAES, initial commercial plants are now likely to require longer planning, permitting, and construction lead-times than technically is possible. For the other technologies, resolution of cost and performance uncertainties and cost reduction is not taking place at a rate sufficient to satisfy utility and nonutility investors before the late 1990s.

If electricity demand growth should accelerate by the early 1990s, the first choice of utilities is likely to be to expand conventional central station generation capacity. Utilities, however, may not be able to invest adequately in this choice, and could encounter serious problems in meeting increased demand should it occur. Accelerating the availability of new, smaller scale, more flexible technologies could be a prudent way to give utilities more choices.

Utilities are more cautious than they were a decade ago about investing in new technology, and they impose rigorous performance tests on investment alternatives. Advanced commercial demonstration projects are especially important in accelerating development and deployment of new technologies, as has been shown by several efforts, sponsored by industry and government, and managed by the utilities. Also, by working closely with regulators and carefully managing construction, demonstrations and initial commercial plants are less likely to require long lead-times.

Where cost and performance improvement is of greatest concern—primarily for photovoltaics, solar thermal, geothermal, and batteries—one approach to accelerating development would be to increase or concentrate Federal research and development efforts on those technologies. For load management as well as certain generating technologies—specifically fuel cells, photovoltaics, solar thermal technologies, and batteries—economies of scale in manufacturing could reduce cost substantially.

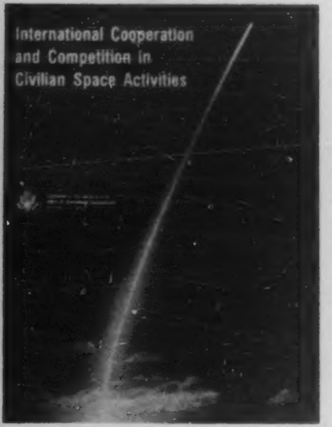
There are other approaches that can complement Federal efforts in technology development. The reemergence of nonutility power production is and can continue to be an important test bed for some of these new generating technologies. For nonutility power producers, the Renewable Energy Tax Credit (RTC) and the recovery of full avoided costs under the Public Utility Regulatory Policies Act (PURPA) have been crucial in the initial commercial development and deployment of wind and solar power generating technologies.

Without some form of favorable tax treatment and high avoided costs, continued development of much of the domestic renewable power technology industry may be slowed significantly. Even for those technologies for which development would continue if the RTC were withdrawn, principally geothermal and wind, that development would be accelerated with favorable tax treatment.

Cooperative agreements among utilities, public utility commissions, and government can provide another mechanism for supporting advanced commercial demonstration projects of new technologies. Utility involvement would likely increase if commissions were to encourage greater R&D expenditures by electric utilities. Projects also could be financed with an equity contribution from the utility and the remainder through a "ratepayer loan" granted by the commission, possibly federally guaranteed.

Finally, the contribution of new generating technologies is likely to increase if utilities are allowed full benefits under PURPA; if the restrictions on the use of natural gas in power generation are removed; and if steps are taken to streamline the mechanisms for wheeling of power through utility service territories.

International Cooperation and Competition in Space Activities



The United States faces the difficult challenge of adapting rapidly to the increasing volume and complexity of international civilian space activities. Recent changes in the political, economic, and technical aspects of outer space raise five important issues for Congress:

1) How to define the Federal and private sector roles: High technological and economic risks and uncertainties continue to hinder private investment in space. Future technology, trade, and regulatory policies, designed to lower these risks, could aid in developing a wide array of internationally competitive commercial space applications by the 1990s. However, substantial commercialization will also depend strongly on favorable market developments.

As the U.S. private sector becomes more involved in space activities, several government agencies in addition to the National Aeronautics and Space Administration (NASA) will have to play a broader role if the United States is to have an effective and competitive space policy. NASA, by itself, is not well-equipped either to promote or to regulate growth in the commercial exploitation of space. Government attempts to stimulate commercial space activities must be based on realistic analysis of domestic and international markets and on information provided by the private sector. Such efforts should be the responsibility of agencies versed in domestic commerce and regulation, international trade, and foreign affairs. Moreover, the regulation of "space industries" should be integrated with the regulation of their terrestrial counterparts.

2) How to maintain international competitiveness in space technologies: Although the United States is dominant in most space research, technology development, and commercial systems, Western Europe and Japan are now marketing space-related goods and services in direct competition with the United States. Western Europe has developed the successful Ariane launch vehicle and the SPOT land remote sensing system. Japan offers strong commercial competition in satellite Earth stations and is developing ocean and land remote sensing systems. Continued U.S. leadership in space will require thoughtful congressional articulation of national space goals, and well-designed Administration strategies.

3) How to help U.S. firms maintain access to international markets: Large parts of the international market for satellite communications equipment and services are closed to international competition. Where open competition exists, U.S. firms continue to dominate the market for communication satellites and to be competitive in satellite network

services and equipment. Greater access to international markets in services and equipment will require continued efforts by the U.S. Government to secure increased opportunities for U.S. firms.

4) Ways to get the most out of U.S. participation in international cooperative space projects: Cooperative space projects continue to help maintain U.S. prestige and influence, support global economic growth, and increase access to information across national borders. Such cooperation should continue to involve developing countries, especially because they are becoming a significant market for space-related goods and services.

5) What should be the future of U.S. space activities: The United States has not achieved wide agreement on a long-term agenda for the civilian space program. The recently appointed National Commission on Space, authorized in Public Law 98-361,[1] could help develop a national consensus on U.S. space goals and objectives, but only if it seeks wide input from both private and government sources outside the traditional "space community."

OTA assessed space science and several space technologies which are at different stages of development:

- Space science: International cooperation in space science continues to be a major source of cultural, economic, political, and social benefits for the United States. The major driving force behind such cooperation is the prospect of reducing U.S. expenditures by sharing costs and knowledge. For example, the United States has chosen a secondary, supportive but low-cost, role in the international study of Halley's Comet. Although the United States still leads in space science, it faces increased competition. Cooperation has contributed to the overall favorable competitive posture of the United States. Therefore, the United States must remain cooperative in space science in order to remain competitive.
- Satellite communications: Because commercial investment dominates this sector, policies on economic regulation, international trade, and intergovernmental agreements have a greater effect than "space policies." Congress can help decide how much competition U.S. telecommunications firms will be allowed to give to INTELSAT,[2] how vigorously to support the entrance of U.S. firms into overseas service and equipment markets, and how best to further U.S. economic and foreign policy objectives at the International Telecommunication Union's upcoming ORB-85 meeting on the geostationary orbit. Finally, it must determine how many Federal dollars to spend on research and development to keep U.S. industry competitive.
- Remote sensing from space: By 1990, Canada, ESA, France, Japan, and the Soviet Union expect to deploy ocean or land remote sens-

---

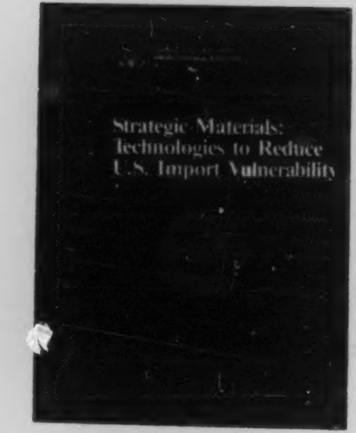
[1] Passed by Congress on June 28, 1984, and signed by the President on July 16, 1984. Commission members were announced on Mar. 29, 1985.

[2] International Telecommunications Satellite Organization.

ing systems. The transfer of the Landsat system to private ownership may increase U.S. competitiveness in land remote sensing. Unless a sufficient market for data emerges, to be successful such transfer will require continuing subsidy. The United States could also preserve its leadership in remote sensing technology by continuing to press for the joint construction of an international polar-orbiting meteorological satellite system, close coordination of future international ocean remote sensing activities, and a central role in the worldwide distribution of ocean remote sensing data.

- Space transportation: The entry of ESA's Ariane booster into the international launch vehicle market, and a continuing U.S. private sector interest in selling launch services, require the U.S. Government to reassess its traditional role as sole provider of launch services. Debate has focused on the price charged for Shuttle launch services and competition with Ariane. Leaving Shuttle prices low will continue to hinder the development of a U.S. private launch industry and entail greater cost to the taxpayer. Raising Shuttle launch prices closer to their real costs would slow private investment in other space sectors. Neither course of action is likely to change significantly the market share captured by Ariane.
- Materials processing in space: The economic feasibility of manufacturing commercial products in space remains highly uncertain. More basic and applied research is needed to establish whether such products can compete with products manufactured on Earth. The U.S. Shuttle is an important research tool for materials processing. Because they have strong programs in materials processing, Europe and Japan should be viewed as valuable partners for international cooperation in the basic research phase. If further research is successful in developing commercially important processes, such cooperation could result in undesirable technology transfer.

Strategic Materials: Technologies to Reduce U.S. Import Vulnerability


Strategic Materials:
Technologies to Reduce
U.S. Import Vulnerability

The nations of southern Africa are the United States' major suppliers of chromium, cobalt, manganese, and platinum group metals (PGMs), all essential to defense and the civilian economy. The principal alternative supplier to the United States is the Soviet Union. Reliance on the Soviet Union is an obvious concern, but there is also uncertainty about the continuity of supplies from southern Africa.

There is almost no domestic production of any of these metals. The United States maintains a stockpile of strategic materials, but it can only be used for defense applications. The non-defense economy remains vulnerable to disruptions of supply.

No single technical approach to reduce U.S. reliance on imports of strategic materials will work by itself. A combination of actions, specific to each metal, must be undertaken. An overall strategy would encompass three technical approaches:

1. *Diversify the supply of strategic metals by developing known deposits, both foreign and domestic, and by exploring for new deposits.*

The production of cobalt and manganese can be diversified through expansion or development of known deposits in Australia, Indonesia, the Philippines, Canada, Brazil, Mexico, and Peru. Opportunities to diversify chromium and PGM production are more limited. The PGM deposit in Stillwater, Montana, is one of the few deposits under active consideration for exploitation.

Exploration for deposits of strategic materials is difficult, expensive, and often unsuccessful. Improvements of geologic understanding and the tools of exploration would increase the likelihood of success.

2. *Decrease the demand for strategic metals by improving manufacturing processes and recycling of strategic metals from waste and scrap.*

Improved casting and forging technologies are already reducing cobalt requirements for the manufacture of superalloy components for jet engines, the largest and one of the most critical uses of cobalt in the United States. Similarly, improved steelmaking technologies and operating practices and the increased use of electric arc furnaces may reduce by about 50 percent the imported manganese needed to produce each ton of domestic steel.

Recycling of PGMs from automobile catalytic converters is increasing, and will become a major source in the future. Technologies for the recovery of chromium and cobalt from obsolete products have been developed and appear promising. However, low metal prices and the cost of testing new processes discourage the investments needed for commercialization.

3. *Identify and test substitute materials for current applications and develop new materials with reduced strategic material content for current and future applications.*

Potential substitutes for stainless steel have been developed that could reduce chromium requirements in many applications by one-third, and laboratory tests indicate that it is possible to reduce cobalt content of many superalloys by about 50 percent. In the longer term, inproved ceramic and composite materials may become important alternatives to chromium and cobalt alloys.

Although substitute alloys may have lower requirements for strategic materials, they offer consumers only limited economic advantages, which are often offset by the cost of testing and certification of the materials and modification of manufacturing processes.

Advanced casting and forging techniques, improved steelmaking systems, and recycling processes for automotive catalytic converters are economically advantageous and are being implemented by private industry without government intervention.

However, other technological approaches will achieve only limited application, unless the government takes a larger role in promoting the development and use of strategic materials technology.

Policy Options

The government could take a number of actions, spanning a range of cost and degree of involvement, to promote the technical alternatives to strategic materials vulnerability:

- Emphasize the collection and dissemination of mineral and material data to improve planning for mineral exploration and exploitation and for conservation technologies and substitution.

Government already plays a key role in providing essential information about strategic materials. An expanded role could include more emphasis on identification of foreign investment opportunities in strategic material development, sponsorship of a substitution information "bank," development of better data about domestic mineral occurrences, and periodic reexamination of trends in strategic materials recycling and conservation.

- Support mineral exploration and materials research and development (R&D) in order to move promising mineral and material technologies closer to practical application.

Implementation of any technical approach to reduce import vulnerability will require a continuing R&D effort, most of which would need government support. Decentralized R&D programs need better coordination if common objectives, goals, and purposes are to be met.

Federal funding of strategic materials R&D in the areas of recycling, substitution, and advanced materials appears adequate to keep pace with the changing industrial mix in the economy. Prospects for a major domestic discovery of one or more of these minerals are not promising, but could possibly be enhanced through greater support for public and private exploration research, including basic research on geological theories of mineral occurrence, improved geophysical, geochemical, and drilling equipment, and more intense study of the resource potential of Federal lands.

- Encourage the adoption of new materials technologies by providing assistance for education and training related to advanced materials, manufacturing technology, and metal processing and recycling systems.

Advanced materials, now in their infancy, hold promise of altering the mix of basic materials used in many applications now dependent on strategic materials. International competition for supremacy in these emerging markets is strong. Other countries, including Japan, emphasize the technical education and training of workers in these fields more than the United States. Increased government support to U.S. educational institutions working in conjunction with the advanced materials industry may be needed to ensure competitiveness in these fields.

- Develop, test, and certify alternative technologies and materials for use in defense and commercial applications.

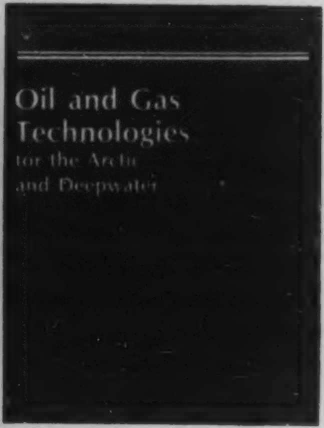
In cases where the principal barrier to commercialization of a technology is the cost of demonstration and pre-commercial development, or where benefits arise from having the technology or material "on-the-shelf," the government could support the construction and operation of demonstration plants or the testing and evaluation of substitute materials.

- Encourage investment in domestic mineral development, metal processing facilities, and new technologies for recycling scrap.

The economics of nearly all opportunities for domestic mineral development are discouraging to potential investors. If the benefits of domestic mineral production are desirable from the public's perspective, however, assistance could be provided in the form of subsidies, purchase commitments, loan guarantees, tax incentives, or other government financial aid. Such programs need not be limited to mineral production; processing of ores and metals, production of substitute materials, and operation of recycling facilities could be similarly encouraged. Such financial assistance programs could be expensive, however, so that their cost and effectiveness, compared to other alternatives, need to be carefully considered.

The basic legislative framework to implement any of these options is largely in place. In recent years, however, the potential for supply interruptions has been overshadowed by more immediate problems. If materials import vulnerability is to be reduced through technical alternatives, Congress would have to continue to emphasize the importance of implementing these alternatives.

Oil and Gas Technologies for the Arctic and Deepwater



Oil and Gas
Technologies
for the Arctic
and Deepwater

Most of the undiscovered oil and gas in the United States is expected to be in offshore Arctic areas, in deepwater, or onshore in Alaska; but exploratory drilling in the OCS frontier since 1978 has been discouraging. As a result, the Department of the Interior recently lowered its estimates of economically recoverable offshore oil by 55 percent and natural gas by 44 percent.

The extent of our offshore oil and gas resources will be confirmed only by actual drilling. In the 30 years since the Federal offshore leasing program began, about 2 percent of the U.S. Outer Continental Shelf (OCS) has been leased; less has been explored.

OTA warns that reliance on speculative estimates of offshore oil and gas resources in national energy planning could jeopardize the future strategic and economic position of the United States. As economic recovery and potentially lower oil prices stimulate consumption, the United States will again face rising petroleum imports unless substantial new domestic reserves are discovered.

Despite recent discoveries in the Gulf of Mexico and offshore California, additions to proven reserves of oil continue to fall. Although more will be known about U.S. offshore petroleum resources after additional exploration, the Department of the Interior's lowered expectations for OCS oil and gas indicate that the Federal Government should develop strategic plans now if we are to meet our future energy needs. Part of the plan should include determining as soon as possible the extent of oil and gas resources in the OCS.

New technologies are now being used for exploration in the harsh environments of the Arctic and deepwater frontiers, but production technologies are still in the development and testing phase. New approaches may be needed to reduce the environmental and safety risks which could accompany expanded oil and gas activities in the harsh operating conditions of the Arctic and deepwater regions.

Because of severe conditions in these areas, large investments are needed to operate and only very large discoveries will be profitable to develop. If "giant" discoveries are not made in industry's first round of exploration, which is now underway in the most promising areas of the frontier regions, the government may need to consider a "second-round" leasing policy, which shifts more of the economic risks to the government, to induce the industry to drill second-level prospective structures, which could lead to the development of smaller oil and gas discoveries, now considered economically marginal.

OTA found that the OCS Lands Act appears to provide Congress and the executive branch with enough room to guide the leasing program in any direction that public policy may dictate. In general, the Act allows the administrative flexibility needed to adjust leasing terms and conditions to deepwater and Arctic frontier areas.

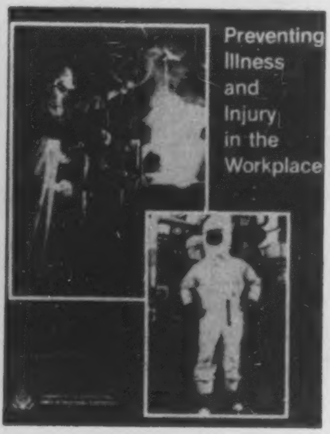
Several problems continue to influence the pace of exploration for new resources in the Nation's offshore frontiers:

- *Area-Wide Leasing.*—Efforts to offer larger offshore areas for tract selection by industry continue to meet with opposition from State and environmental interests. The area-wide leasing system, substantially modified since its implementation in 1982, allows the early identification and exploration of prospective areas by the industry. It may be the most efficient and cost-effective leasing approach for Arctic and deepwater frontier regions, but it requires that the Secretary of the Interior adequately balance environmental considerations and the concerns of the coastal States with industry tract preferences.
- *Military Operations.*—As offshore petroleum activities have expanded to the frontier areas, conflicts with military uses have become more obvious. An estimated 40 million acres are excluded from offshore leasing in the entire OCS, and as much as 75 million additional acres have military restrictions on the density of drilling operations. While the Departments of the Interior and Defense now negotiate military limitations on offshore acreage, a legal conflict exists as to who has final authority for withdrawing offshore lands from energy development.
- *Disputed International Boundaries.*—Disputes over ownership of offshore areas with Canada, the Soviet Union, Mexico, and perhaps Cuba could constrain exploration in some highly prospective offshore areas. There is also uncertainty concerning the legal definition of the boundaries of the Outer Continental Shelf. Unless the disputes are resolved or joint exploration agreements are negotiated, these boundary regions may not be evaluated for oil and gas potential.
- *Alaskan Oil Export Ban.*—Export restrictions on Alaskan offshore oil adversely affect the profitability of Arctic operations and the attractiveness of exploration and development in this area. However, removing these restrictions could also have adverse economic effects on the U.S. maritime industry, which now carries oil on American flag vessels, and could perhaps affect future oil supplies in times of emergency. Japan would be the most likely importer of Alaskan oil, but it is not certain that markets there could be established.
- *Oil Spills.*—While the offshore industry has a good record of preventing oil spills, it has little experience in cleaning up oil spills in Arctic and deepwater areas. Most cleanup technology was de-

veloped for temperate, nearshore regions. Arctic conditions especially may present extensive cleanup problems, including extreme cold and ice, darkness, remoteness, and lack of facilities. Standardized testing of oil spill countermeasures under Arctic conditions could help evaluate the capabilities of available equipment and indicate the need for new strategies.

- *Offshore Safety.*—At present, government collection and analysis of offshore safety and injury data is inadequate for evaluating the extent of risks and the effectiveness of safety programs in frontier areas. Given the severe conditions of frontier operations, government inspection programs and evacuation drills need to be evaluated carefully and may need to be increased.

Preventing Illness and Injury in the Workplace



The Occupational Safety and Health Act of 1970 sought "to assure so far as possible . . . safe and healthful working conditions" for the U.S. work force. But the toll of work-related disease and injury remains significant. Each year about 6,000 American workers, about 25 every working day, die from workplace injuries. Depending on what kinds of injuries are counted, nonfatal injuries total between 2.5 and 11.3 million annually—10,000 to 45,000 cases per working day. Although information about work-related illnesses is too poor to generate reliable estimates of the number of deaths and diseases, there is general agreement that exposures to hazardous working conditions threaten the health of particular groups of workers. OTA has examined occupational health and safety and presents options for congressional action that could facilitate hazard identification, enhance the development of control technologies, and change the incentives that affect employer decisions to control workplace hazards.

Identification of safety hazards and collection of injury data is facilitated by the usually close connection between injury-producing events and injuries. Identifying health hazards, however, is impeded by the often long period of time between exposure and illness, similarities between diseases caused by occupational and nonoccupational factors, and failures to recognize occupational causes of disease. More concerted effort and better use of existing methods would enhance hazard identification.

Controls for safety hazards include machine guarding, process redesign, work practices, and personal protective equipment. Design and selection of these controls has largely been based on personal experience, common sense, and recommended "good practice," with little systematic data collection, epidemiologic analysis, and experimental research. Controls for health hazards include substitution of less dangerous substances, enclosure and ventilation of processes, changes in work practices, and personal protective equipment. These controls have often been developed plant by plant, substance by substance, with much trial and error. Including controls in the initial design of workplaces and equipment is more protective and less expensive than adding them later. But frequently, health and safety controls have not been incorporated into workplace design and operation.

"Engineering controls," e.g., machine guards and ventilation systems, function continuously and reliably to prevent workers' coming in contact with hazards. Although personal protective equipment is sometimes suggested as equal to engineering controls, it seldom works as well and is best restricted to situations where engineering controls are not available. Research on engineering controls, personal protective equipment, and attention to the health and safety problems that may be posed by new technologies could pay off in improved controls and reduced costs. A pressing need is information for evaluation and certification of personal protective equipment.

OTA examined incentives and imperatives that influence decisions by employers to control workplace hazards. The important incentive of employer concern for workers' health and safety produces many voluntary actions to control hazards, but it is often limited by competitive pressures. Providing information to workers and employers is necessary, but not sufficient to guarantee effective hazard identification and control. Government-provided financial incentives, such as changes in business taxes or provision of financial assistance or loans, might encourage installation of controls, but any new program would generate costs. Employers' efforts to reduce costs associated with workers' compensation and lawsuits can lead to the installation of controls, but these incentives are limited, especially for occupational illness. Collective bargaining and workers' rights concerning health and safety can also lead to installation of controls, although collective bargaining is restricted to the small fraction of the work force that belongs to labor unions.

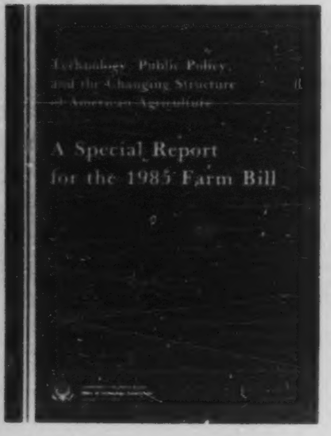
The Occupational Safety and Health Administration (OSHA), charged with ensuring safe and healthful workplaces, has issued only a handful of new or revised regulatory standards. The standards and regulations it enforces are still predominantly those that were adopted in 1971. Furthermore, the incentive provided by OSHA's enforcement activities is limited because of generally infrequent inspections and comparatively low penalty levels. While there have been a few successful OSHA regulations, especially for health hazards, most studies on injury rates have found that OSHA has had either no effect or only a limited effect. According to OTA's analysis, the decline in injury and fatality rates between 1979 and 1983 resulted from the effects of the economic slow down.

The National Institute for Occupational Safety and Health (NIOSH) conducts research on hazard identification and control technologies, disseminates information, and educates health and safety professionals. The largest share of its budget is for hazard identification; research on controls receives a relatively small portion. OSHA and NIOSH have probably increased awareness about occupational hazards and spurred efforts to control, but evaluation of many of their specific programs is needed.

Safety and health in small businesses can be aided by increasing OSHA and NIOSH consultation; providing loans for compliance with regulations; testing the safety of products used by small businesses; and providing industrial hygiene, safety engineering, worker training, and occupational medical services in places currently lacking these services.

Periods of modernization and replacement of plant and equipment offer opportunities to improve health and safety. Compliance with OSHA's vinyl chloride and cotton dust standards demonstrate that simultaneous improvements in productivity and worker health and safety are possible.

A Special Report for the 1985 Farm Bill



Technology, Public Policy, and the Changing Structure of American Agriculture

A Special Report for the 1985 Farm Bill

Rapid advances in biotechnology and information technology are revolutionizing agricultural production and dramatically altering the structure of the U.S. agricultural sector. The potential impacts of adopting these technologies also have important policy implications for Congress as it begins debate on the reauthorization of the 1981 farm bill.

One impact will be technology's role, under current policy, in creating a surplus of certain commodities in the immediate future. Overall, the balance of agricultural supply and demand is expected to fluctuate in unpredictable ways. However, for certain commodities, notably dairy products, further U.S surpluses are likely. The adoption of new technologies coupled with current farm policy will exacerbate that problem. The implication for policymakers is the need for a farm program that more easily allows for adjustments in periods of shortages and surpluses, rather than remaining fixed.

New technologies also are contributing to a shift from an agricultural system dominated by moderate-size farms—the traditional backbone of American agriculture—to one dominated by large and very large industrialized farms. New technologies have allowed farmers to operate larger farms while reducing operating costs. Public policy has provided further incentives for expansion, such as price supports and tax incentives.

The farmers who are most aggressive in the early adoption and application of new technologies generally are benefiting the most. But the technologies that can keep farmers competitive are costly and complex. Farmers who lack the capital or expertise to adopt new technology early enough to maintain a competitive edge must seek supplementary off-farm income, find some special niche for their products, or give up farming altogether.

This last alternative has become a frequent choice—the moderate-size farms are rapidly disappearing. Moderate farms, those with gross sales ranging from $100,000 to $199,000 each year, are failing to compete for their historical share of farm income. Their net income has decreased from 21 to 15 percent of total farm income between 1974 and 1982. In contrast, the net farm income of those farmers with sales in excess of $200,000 grew from 35 to 84 percent of the total in the same period. As a group, these large and very-large farmers are relatively well-off.

By comparison, part-time farms, with sales in the range of $20,000 to $99,000, have declined from 39 to 5 percent of net farm income and farmers with sales of less than $20,000 had a negative net farm income in 1982. However, in contrast to larger farms, these farms rely on off-farm employment as a primary source of income.

If we disregard or discourage technological advances, as some have suggested, American farmers would not remain competitive in international markets. A general retreat from traditional R&D support in agriculture would harm the whole American farm system, not just some of the farmers.

If a decision is made to slow the decline of the moderate-size farm, policymakers' first step could be to provide ways to make new technologies more available to these farms and to provide training in their use. Targeting income support to these farms also would be effective, although even this measure may not help dairy farmers in some regions.

Second, despite the apparent advantages of very large farms, their operators may need a loan safety net to help them weather price instabilities and the rigors of the world marketplace. Unlike most of their moderate-size counterparts, large farms are more likely to survive without income supports.

Third, agriculture policymakers could help particular groups and regions make the transition to different endeavors, for example, programs to retrain agricultural workers for jobs in other sectors or to change to alternative kinds of farming. Farmers in the Great Lakes States region, for instance, could gain some comparative advantages by switching from dairy production to corn.

Finally, and perhaps most significantly, farm programs must be considered in the context of these strong technological, economic and institutional forces. Farm programs can merely speed up or slow down these forces of change—they cannot reverse the trends.

Superfund Strategy

EPA has made progress in the Federal Superfund program for cleaning up toxic waste sites, and much can be learned from the initial efforts to improve protection of public health and the environment.

SUPERFUND
STRATEGY

The Environmental Protection Agency's (EPA) low estimate of Superfund costs can be traced to a lack of detailed planning for the program and optimism about both the number of toxic waste sites that will require cleanup and the effectiveness of cleanup technologies. While EPA estimates that about 2,000 sites will reach the National Priorities List (NPL), on which sites must be placed to qualify for a permanent cleanup, OTA estimates that 10,000 sites (or more) may require cleanup. With Superfund's existing resources, it is not technically or economically possible to permanently clean up even 2,000 sites in less than several decades. OTA defines permanent cleanups to be those where the likelihood of recurring problems with the same site or wastes have been minimized through the use of treatment rather than containment technologies.

Only 30 percent of the 538 sites now on the NPL are receiving remedial cleanup attention even though about $1 billion (two-thirds of the initial 5-year program's funding) have been committed. Initial actions and cleanups now emphasize the removal of wastes to land disposal facilities, which themselves may become Superfund sites, or wastes are left on site. Current "remedial cleanups" tend to be impermanent. Some sites get worse, and repeated costs are almost inevitable. Environmentally, risks are often transferred from one place to another, and to future generations.

Underestimating national cleanup needs could result in environmental crisis years or decades from now. The issue now is not so much about whether or not to have a continued, expanded Superfund program as it is to choose between continuing with the current approach or, based on experience, to restructure the program.

OTA finds that a two-part strategy (see below) could offer cost and time advantages over the current program. Even so, costs to Superfund could easily be $100 billion—out of total costs to the nation of several hundred billion dollars—and a sensibly paced effort could take up to 50 years to clean 10,000 sites. This two-part strategy could be advantageous regardless of the size of the Superfund program.

(I) In the near term, for perhaps up to 15 years, the strategy would focus on: a) early identification and assessment of potential NPL sites,

b) initial response to reduce near-term threats at all NPL sites and prevent sites from getting worse, c) permanent remedial cleanups for some especially threatening sites, and d) developing institutional capabilities for a long-term program. A substantially larger Superfund program would be needed to carry out these efforts. Case studies by OTA and others reveal that both immediate removals and remedial cleanups have been largely ineffective for their intended purposes. Under the two-part strategy, initial responses would emphasize covering sites and temporarily storing wastes and contaminated materials to reduce groundwater contamination and, where technically and economically feasible, excavating wastes to minimize releases into the environment.

(II) Over the longer term, the strategy would call for more extensive site studies and focus on permanent cleanups, when they are technically feasible, at all sites that pose significant threats to human health and the environment (unless privately or State-funded cleanups offering comparable protection have taken place). These cleanups would draw on the institution building that occurred during the first phase.

Federal support could contribute in five areas:

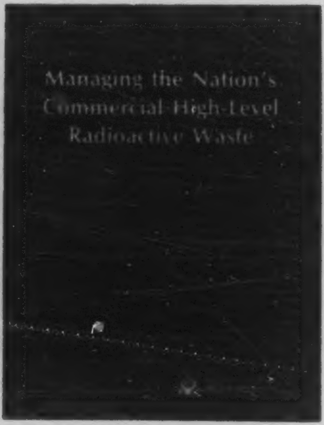
1. Obtain more information on health and environmental effects and develop specific national cleanups goals. Without this effort, selecting technologies, estimating costs, and evaluating public and private cleanups will be difficult and contentious.
2. Provide substantially more support for developing and demonstrating innovative, permanent cleanup technologies. Permanent remedies, which destroy, detoxify, or otherwise treat wastes will be necessary to any cost-effective, long-term Superfund program; many innovative approaches exist, but they face substantial barriers to demonstration and use, such as the absence of protocols to evaluate their effectiveness.
3. Provide increased support for EPA so it can improve technical oversight of contractors.
4. Increase support for training and education: expanded national cleanup effort could increase the need for certain technical specialists fivefold by 1995; shortages of experienced technical personnel such as hydrogeologists have already been noticed.
5. Support public participation in decisionmaking and provide technical assistance to communities.

OTA considered only one use of Superfund, the remedial cleanup of hazardous waste sites that are "uncontrolled"—that is, because actual or potential releases of hazardous substances into the environment must be managed. A number of other applications exist and could increase in the future. OTA's estimate of additional waste sites include: 5,000 sites from the more than 600,000 open and closed solid waste facilities, such as sanitary and municipal landfills; 2,000 from an improved site identification and selection process; and 1,000 from hazardous waste management facilities operating with ineffective groundwater protection standards.

A much larger Superfund program would likely mean that more reliance would have to be placed on general tax revenues or some other broadly based tax. Along with continued use of the tax on chemical and petroleum feedstocks, a tax on hazardous wastes could raise significant sums, but this latter tax would generate significant revenue only in the near term, if less hazardous waste is generated over time. If such "waste-end" taxes, already adopted by 20 States, were made simple to administer, they would aid in reducing the generation of hazardous waste and use of land disposal and, hence, the creation of still more Superfund sites.

Managing the Nation's Commercial High-Level Radioactive Waste

The Nuclear Waste Policy Act of 1982 (NWPA) establishes in law a comprehensive Federal policy for commercial high-level radioactive waste management. NWPA provides sufficient authority for developing and operating a waste management system based on disposal in mined geologic repositories.



Managing the Nation's Commercial High-Level Radioactive Waste

The Act requires the Department of Energy (DOE) to submit to Congress three key documents:

1. a Mission Plan, containing both a waste management plan with a schedule for transferring waste to Federal facilities and an implementation program for choosing sites and developing technologies to carry out that plan;
2. a monitored retrievable storage (MRS) proposal, including a design for long-term Federal storage facility, an evaluation of whether such an MRS is needed and feasible, and an analysis of how an MRS would be integrated with the repository program if authorized by Congress; and
3. a study of alternative institutional mechanisms for financing and managing the radioactive waste program, including the option of establishing an independent waste management organization outside of DOE.

As part of its analysis of NWPA, OTA identified the elements of a Mission Plan that can meet the requirements of the Act using only the authority it provides.

The major difference between this "OTA Mission Plan" and DOE's Mission Plan, delivered to Congress in June 1985, lies in the measures they use to provide confidence that spent fuel will be removed from reactor sites within a reasonable period. DOE's Mission Plan uses a repository development strategy that assumes that major problems are unlikely and can be dealt with adequately when and if they occur. For example, backup technologies and sites would be developed only if and when problems are encountered. To give confidence that waste can be accepted by 1998, even if there are significant delays in the repository program, DOE would ask Congress for early authorization to site and license an MRS facility.

The OTA Mission Plan relies on geologic repositories alone, and contains features to increase confidence that they will be available without major delays. MRS facilities would be needed only in the unlikely event that there are major unanticipated difficulties with geologic disposal. The key to confidence in this Plan is early development of backup repository technologies and potential sites so that they will be available quickly if problems arise. This anticipatory approach might cost more at the start, but the long-term financial and political costs could be less than those of a plan that reacts to problems after they are encountered.

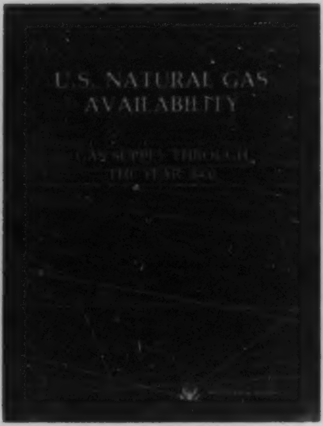
The major issues to be addressed in the MRS proposal are when and whether DOE should be authorized to construct a centralized MRS facility. It now appears that MRS facilities will not be necessary for safe waste management unless major unanticipated difficulties are encountered with geologic disposal. OTA's analysis suggests that, to aid congressional deliberations, the MRS proposal submitted by DOE should evaluate at least three alternatives:

1. Early siting, licensing, and construction of an MRS facility.
2. Federal at-reactor storage beginning in 1998.
3. Deferral of the decision on whether to build an MRS until at least 1990, when the first repository site is to be recommended to Congress.

NWPA also requires DOE to submit a study of alternative institutional mechanisms for financing and managing the radioactive waste system. A public advisory committee established by DOE to address this subject recommended consideration of an independent federally chartered public corporation. OTA's study concludes that creating an independent waste management agency could enhance the credibility of the Act's commitment to developing a complex technological system on a firm schedule. Balancing independence and accountability is a key challenge in designing such an agency. A Mission Plan approved by Congress could play a major role in achieving that balance. Since approval of the Mission Plan is not now required by NWPA, consideration of mechanisms for such approval might be included in any congressional deliberations on establishing an independent waste management agency.

U.S. Natural Gas Availability: Gas Supply Through the Year 2000

Despite current optimism, the uncertainty of both the future production and recoverable resources of natural gas in the United States is still high. For example, production from traditional domestic sources of natural gas could range from slightly higher than today's rate to a sharp reduction within 10 to 20 years. Thus, complacency about U.S. natural gas availability over the next few decades would be an error.


U.S. NATURAL GAS
AVAILABILITY
GAS SUPPLY THROUGH
THE YEAR 2000

If a downturn in production from its traditional sources were to occur, the United States could turn to several supplemental sources of natural gas, including "unconventional" gas sources, especially tight gas, Devonian shale gas, and coalbed methane; Alaskan natural gas; increased pipeline gas imports from Canada and Mexico; and liquefied gas imports. Each of these supplemental sources is promising, but also uncertain because of possible technical roadblocks, geological unknowns, and sociopolitical difficulties. Given these uncertainties, reliance on only one or two of the supplemental sources may still leave the United States vulnerable to future gas supply shortages. In OTA's opinion, however, the probability of the United States obtaining adequate gas supplies for the next two decades is high if access to *all* sources of natural gas is *vigorously* pursued.

Lower 48 States "conventional" natural gas, gas that can be produced domestically with current technologies (or their simple extensions) at prices not much higher than today's, is the mainstay of the present gas supply of the United States (well over 90 percent). OTA projects the range of plausible year 2000 production rates for conventional gas to be 9 to 19 trillion cubic feet per year (TCF/yr), compared to today's rate of about 17 TCF/yr. A plausible range for the remaining recoverable resources in the Lower 48 is 430 to 900 TCF. The critical areas of uncertainty include: the role of small gasfields, and gas in hard-to-locate geological settings; the potential of the "frontier" areas, including very deep gasfields; the potential for improving gas recovery from older gasfields; and the proper interpretation of past discovery trends.

Tight gas, in extremely low-permeability rock formations, is found in basins throughout the United States and is produced by fracturing the rock around the wellbore to stimulate gas flow. OTA projects that incremental tight gas production in 2000 could range from 1 to 4 TCF/yr or perhaps even higher. A plausible range for the recoverable resource is 100 to 400 TCF, with some potential for a few hundred TCF more. Critical areas of uncertainty include: the volume of recoverable gas in the Northern Great Plains and in the many less explored basins; the ability of new fracturing techniques to produce gas from small reservoirs ("lenses") not directly drilled; and the ability to create very long fractures at low costs.

Devonian shale gas is natural gas found in low-permeability shales of the Devonian geologic period, primarily in the Appalachian Basin. The year 2000 production of Devonian shale gas, over and above current production, could range from negligible amounts to about 1.0 to 1.5 TCF/yr. The resource base ranges from 20 to 100 TCF, with additional potential if gas can be produced from shales without a well-developed natural fracture system.

Coalbed methane is natural gas created as part of the coal formation process and trapped in the coal seams. Although there is considerable new drilling aimed at recovering this resource, a projection of future production rates is too speculative at this time. A likely range for the recoverable resource is 20 TCF to a few hundred TCF.

Imports and Alaskan natural gas currently provide about 1 TCF/yr to the Lower 48, and could range from 1 to about 6 TCF/yr by 2000 depending on price, delivery costs, and demand growth in the exporting nations as well as a variety of sociopolitical considerations.

Aside from technical uncertainties, all projections of future gas supplies from the various sources are vulnerable to uncertainties about fuel prices, economic activity, energy demand, and other unpredictable variables.

Natural gas policy. One implication of OTA's projections of future gas production and recoverable resources is that any policy that would tend to restrict U.S. gas availability to its traditional domestic sources would increase the likelihood of gas shortfalls by the 1990s. A diversified development strategy, including a willingness to let gas prices seek a market clearing level and an active encouragement of technology development and exploitation of new gas sources, would greatly increase the likelihood that a shortfall could be made up by alternative gas sources.

Given the high risks and long leadtimes necessary to establish new sources of supply, the United States should place a premium on providing an early warning of any impending shifts in gas supply. High priority should be placed on maintaining the Government's data collection and forecasting capability and keeping these functions independent of the Federal policymaking apparatus.

Information Technology R&D: Critical Trends and Issues

INFORMATION TECHNOLOGY
R&D
CRITICAL TRENDS AND ISSUES

By all historical measures, U.S. research and development (R&D) in information technology—communications, computer technology—is not only robust, but is adapting rapidly to changing regulatory structures and increasing world-wide economic competition. Federal and private investments are increasing, universities and industry are forming new institutional arrangements, new technical advances continue to be made, and increasing numbers of students are entering information technology programs.

Despite this adaptation, continued congressional concern is warranted: patterns for the conduct of R&D in the United States that have been successful in the past may be undercut by government-coordinated programs in other nations. The changes taking place in funding and institutional structure for information technology R&D may create issues such as:

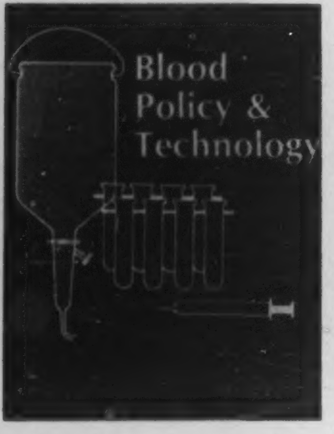
1. Whether current levels of Federal R&D support for information technology (including research on the social impacts of these technologies) are adequate both overall and in the balance of civilian/military priorities, and whether further coordination of research programs within and among agencies is needed.

   The Federal Government is a major supporter of information technology R&D, with the Department of Defense providing over 80 percent of the Federal funding, and civilian funding agencies such as NASA and NIH providing the balance. Private computer and communications firms also have made major contributions, but reduced regulation of telecommunications and divestiture of AT&T have changed the environment for R&D in industrial laboratories. For example, the funding mechanism and, to some extent, the goals of AT&T's Bell Laboratories have changed significantly. Although serious harm to Bell Labs' R&D activities is unlikely in the short term and other R&D institutions may be positively affected by these changes, the changing overall patterns of industrial research need to be watched to see whether the anticipated surge in innovation occurs and whether an increased focus on short-term development will detract from basic research.

2. Unintended barriers to R&D. Federal policy not directly related to science and technology (e.g., antitrust, taxation, immigration, and intellectual property) can inhibit investments in and the conduct of R&D. Congress may wish to remove these barriers in cases where other important policy objectives are not compromised. The passage in 1984 of the Semiconductor Protection Act and the National Cooperative Research Act are examples of congressional action in this area.

3. Access. Computers (including supercomputers), on-line electronic data bases, and communication networks have become major research tools in a variety of science and engineering disciplines. Improved access to these facilities by researchers is vitally important to the U.S. R&D effort. For example, Congress may wish to take steps to encourage the executive branch to improve coordination and management among supercomputer research centers, to encourage access to them through high-speed data communication networks, and to support research on software problems involved with advanced computer architectures.
4. Technical manpower. Federal programs have traditionally encouraged a steady supply of technical manpower and provided equality of access to technological careers. To achieve their purpose, these programs need to be long term and stable. Attempts to make short-term corrections to narrowly defined temporary shortages have generally failed because of the long lead-time required for a program to have an effect, and the errors of predictions.
5. Information policy. Innovation in information technology both influences and is shaped by many Federal policies regarding information and its use—including privacy, computer crime, trade in information and intellectual property. Many foreign nations incorporate their R&D programs in broader comprehensive national information policies that are based on their concepts of the economic and social role of information and information technologies. A more integrated approach to U.S. information policy would help Congress establish priorities and appropriate funding levels for R&D in the technology.

Blood Policy and Technology



The U.S. blood supply today is safer and more types of blood products are available than 10 years ago. But several recent developments are affecting our blood supply: transfusion-related cases of acquired immunodeficiency syndrome (AIDS); efforts to contain health care costs and the related issue of the costs of blood products; and the development of blood substitutes using new recombinant-DNA technologies.

A decade ago, hepatitis B was the primary disease that was transmitted through blood. Hepatitis continues to be the primary blood-transmitted disease, with a relatively new type of hepatitis (non-A, non-B) replacing hepatitis B as the most prevalent. However, the discovery of AIDS in transfused patients and hemophiliacs has become the focal safety issue.

Measures to prevent the spread of disease through blood products include: 1) screening of donors, 2) testing of collected units, and 3) inactivation of micro-organisms that may be in the blood. Donor screening remains the primary line of defense although some laboratory tests, such as that for detecting carriers of the hepatitis B virus, are available. Inactivation procedures depend on the particular blood product in question and cannot be used on the cellular elements of blood without destroying them.

With the discovery of a probable agent for AIDS (human T-cell lymphotropic virus, type III, or HTLV-III), a blood test to detect exposure to the HTLV-III virus may be available soon and used to screen blood donors. Other than indicating that the person has been exposed to the HTLV-III virus, however, the meaning of a positive blood test is uncertain. What to tell these persons and who should have access to their identities have been difficult issues to resolve.

Another current problem for blood suppliers is the prospective payment system Medicare is now implementing. Limits were set on hospital payment rates to provide incentives for hospitals to be cost conscious about the services they provide and the purchases they make. Hospital management is now taking a close look at the prices that they are charged by blood banks. Regional blood centers are concerned that the distribution networks that have been developed could be disrupted, and that they may be unable to support their research and education activities.

Recent advances in biotechnology, particularly in the field of recombinant DNA technology, have raised the prospect of their competing with human donors as the source for some blood products by the end of the 1980s. In the relatively near future, recombinant DNA sources of some plasma proteins will be available and could cause additional problems for organizations that collect blood or plasma.

Overall, the U.S. blood supply system is organized in basically the same way as it was 10 years ago, but the products, services, and technologies offered today are very different. The system consists of two different sectors: 1) a voluntary whole blood and blood components sector, and 2) a largely commercial plasma and plasma derivatives sector.

The report also describes Federal and private involvement in developing and maintaining a safe blood supply; the current structure of the industry; technologies for whole blood collection and processing and for plasma fractionation; the impact of future technologies; current issues in blood policy; and future directions for blood collection organizations.

Given the overall success of the past decade and the transitional nature of present circumstances, the prudent course would be to continue with the cooperative arrangements that have been established over the past years and to monitor key developments to anticipate when particular adjustments need to be made.

Civilian Space Stations and the U.S. Future in Space

CIVILIAN SPACE STATIONS
AND THE U.S. FUTURE
IN SPACE

After 25 years of experience, the United States has the capability to succeed in virtually any civilian space venture it chooses. The Nation is now poised to make a major decision on the future direction of its publicly funded civilian space program: whether or not— and how—to proceed with the acquisition of a "space station." Such a decision can be made only in the context of nationally agreed upon long-term goals. Although there are important reasons for acquiring advanced space infrastructure elements, the lack of clearly defined goals argues against committing at this time to the specific "space station" concept proposed by NASA, the related time-scale, or the currently suggested method of funding.

Without a clear consensus on goals, the "space station" program could become an end in itself, rather than a means to achieve objectively important program goals. The National Commission on Space, created by the 98th Congress, could initiate and sponsor the broad national debate necessary for gaining acceptance of clearly formulated, long-range goals and specific objectives designed to address them.

OTA suggests some broad goals as a starting place for discussion, for example: reduction of the unit cost of space activities, direct involvement of the public, increased international cooperation and collaboration, and broad exploration of the solar system and the universe.

Specific objectives to address these larger goals might include a global natural hazard warning service; a lunar settlement; medical studies of potential direct benefit to the public; direct investigation of asteroids; large numbers of the public visiting space each year; and a global direct audio broadcasting service. All could be attained within the next decade or two, and within currently anticipated appropriations.

There is no such thing as "the" space station, and NASA's proposal is only one alternative in a wide range of options. These range from modest, low-cost extensions of current capabilities to ensembles of space station elements more sophisticated, capable, and costly than NASA is now suggesting.

NASA's "space station" would be of a broadly general-purpose nature, to be used to support over 100 conceptual uses. Few of the proposed activities have been sharply defined or have gained wide acceptance as important objectives of the space program. The best defended are the conduct of life and materials sciences experiments and satellite servicing.

OTA also examined opportunities for reducing the unit cost of space assets and activities, the importance and opportunities involved in greatly enlarging the role of the private sector, and the possibility of different roles for foreign nations in cooperative work. All these issues require attention if the commitment of dollars, technology, and professional manpower likely to be requested for a "space station" is to be fully justified. However, traditional NASA management practices, internal needs, and historical roles inhibit such a thorough reexamination of these issues.

NASA should place relatively less emphasis on accomplishing itself those things that the private sector or other friendly nations can do, including production of much of the technology and facilities envisioned for the "space station." Rather, NASA should pursue cutting-edge technology and undertake exploration and discovery that only it can do.

Some policy options for congressional consideration include:

1. agree, in principle, with NASA's proposal, accepting its $8 billion and 7- to 8-year estimate;
2. ask NASA to present estimates of costs, schedules, and procurement strategies for providing specific major space services, and select elements and strategies from these;
3. decide that obtaining any large amount of new long-term, in-space infrastructure is premature; or
4. simply approve an average annual expenditure rate for acquisition of any in-space infrastructure and let NASA select the elements, acquisition schedules, and procurement strategies based on relative cost and value.

Federal Policies and the Medical Devices Industry

FEDERAL POLICIES
AND THE
MEDICAL DEVICES
INDUSTRY

The Food and Drug Administration's (FDA) regulation of marketing and the Medicare program's payment policies have had the most influence of all Federal health policies on the development and use of medical devices. Such products range from simple, inexpensive items, such as bandages and stethoscopes, to sophisticated, expensive equipment, such as computed tomography (CT) scanners.

The Medical Device Amendments of 1976 significantly expanded FDA's authority to regulate medical devices for safety and efficacy. Evidence indicates that, despite regulation, medical device companies have continued to be profitable and innovative, and new companies are entering the field. But major portions of the Medical Device Amendments have not been implemented by FDA and some may not be workable. As implemented so far, the regulatory process has posed the greatest problem for small manufacturers of contact lenses.

The purpose of the Medical Device Amendments is to protect the public from unsafe and ineffective devices. However, information from FDA's voluntary reporting system has been inadequate for assessing the hazards associated with devices and the law's effectiveness in consumer protection.

The medical devices industry has grown from less than $1 billion in 1958 to more than $17 billion in 1983. Medicare and other health insurance programs have stimulated growth in the medical devices industry by providing a secure and growing market for health care products. Between 1960 and 1982, the share of total medical expenditures paid by third parties rose from 45 to almost 70 percent.

As a result of payment policies, the market has rewarded technological sophistication but not cost consciousness and has fostered devices used in acute care rather than in prevention and rehabilitation.

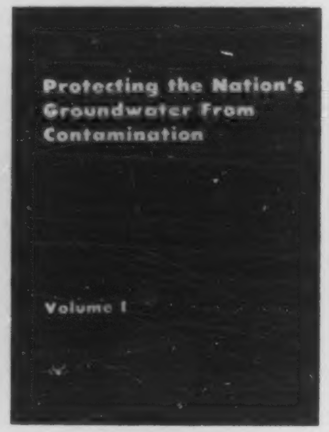
Medicare's new method of paying hospitals prospectively on the basis of diagnosis-related groups (DRGs) has the potential to make hospitals, and hence device manufacturers, more cost conscious. Medicare's DRG hospital payment method also raises some concerns: assurance of quality when providers have financial incentives to minimize the use of devices and possible inefficiencies if device use shifts to locations less financially constrained than hospitals.

Congress has several options to improve regulation of medical devices. One option is to retain the basic framework and intent of the 1976 law and provide guidance to FDA on priorities in its implementation. A second option is to narrow the scope of the law to reflect FDA's current priorities in implementation. A third approach is to exclude certain types of devices from regulation on the basis of their potential risk.

Congressional options in the payment area include encouraging Medicare to develop payment methods that are more neutral with respect to providers' decisions to use devices and that encourage physicians to select the least costly setting of use. A broader approach would be to encourage Medicare to set overall limits on the amount to be paid for care and to permit providers and patients to determine the use of specific devices and other technologies within that limit.

In addition to policies pertaining to payment for health care and regulation of marketing, OTA's report examines Federal policies pertaining to support for research and development, regulation of medical providers, and the development and procurement of devices for veterans. Policy options are provided in each of these areas.

Protecting the Nation's Groundwater From Contamination



Protecting the Nation's
Groundwater From
Contamination

Volume I

Contaminants are being found in the groundwater of every State and are being detected with increasing frequency. Although the quality of only a small portion of the Nation's total groundwater resource may now be impaired, the potential risks of this contamination are significant.

Many substances being found in groundwater are linked to human health hazards including cancers and damage to the liver, kidney, and central nervous system. These substances can also have serious environmental, social, and economic impacts. Adverse effects can be expected to increase because demands for groundwater and the likelihood of exposure to contaminants are growing. Groundwater is now used for drinking by about one-half of the Nation's population; supplies many industrial, agricultural, and domestic requirements; and recharges streams and lakes.

Despite increased Federal and State efforts in recent years, our ability to protect groundwater against contamination is limited. For example, there is no explicit national legislative mandate to protect groundwater quality. In addition, laws and programs vary in the ways they address groundwater; responsible institutions are not coordinated; and programs to protect groundwater and surface water are not integrated.

If groundwater quality is to be better protected, laws and programs must be broadened to include sources of contamination, contaminants, and users of groundwater not now covered. Most programs now focus on contamination from "point" sources, especially landfills and other activities with hazardous wastes (as defined by Federal law). Not generally covered are non-point sources (e.g., pesticide and fertilizer applications) and sources associated with nonhazardous wastes (e.g., residential disposal) and nonwaste products (e.g., leaks and spills from storage tanks). Also, over 200 individual substances have been detected in groundwater, but mandatory Federal water quality standards have been established for only 18 of them. And existing programs are primarily concerned with protecting public drinking water supplies; at least 11 million rural households—as much as 20 percent of the Nation's population—rely on private drinking water wells.

Adequate and sustained Federal support to the States is also required to protect groundwater quality and will involve a balancing among activities to detect, correct, and prevent contamination. This support must be flexible enough to respond both to the site-specific nature of contamination problems and to variations among the States' priorities and capabilities. Federal support could include funding, technical assistance, and research and development.

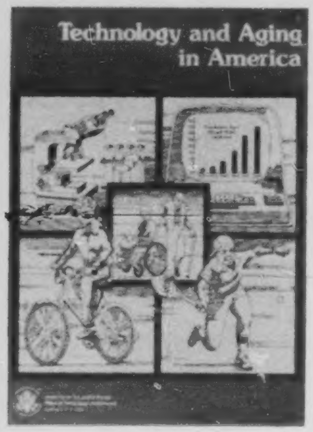
At present, no Federal program earmarks funds for groundwater. As a result, all water quality programs are competing for State grants, some of which have recently been reduced or eliminated. And because groundwater protection activities are expensive, funds are needed by the States for both program development and implementation.

The kinds of technical assistance that Congress may want to consider include: 1) Federal support for training programs to provide an adequate supply of technical personnel; 2) development of criteria and/or guidelines to ensure that detection, correction, and prevention activities are technically sound; and 3) efficient information exchange both to provide the States with information that they require (e.g., about health impacts) and to enable the States to benefit from each other's experiences with protection programs.

Key areas for research and development include the toxicology of individual contaminants and of their mixtures; hydrogeologic investigations in fractured rock; the systematic and efficient analysis of water quality samples; chemical and biological transformations of substances in the subsurface; the prospects for treating contaminated groundwater; and options for prevention.

Technology and Aging in America

A major challenge stretching well into the 21st century will be to maintain the health and functional ability of America's rapidly growing older population, particularly as the proportions in the oldest age groups rise to unprecedented levels. Technology has been the major factor in the growth and increased longevity of the population, and can enhance the ability of older persons (those over 65) to remain vital and active for many years.


Technology and Aging in America

Almost four-fifths of all babies born in the United States this year can expect to live to age 65; only two-fifths of those born in 1900 could expect to do so. More than half of the improvement in life expectancy at age 65 that has occurred since 1950 has been gained in the last 12 years.

For the first time older persons outnumber teenagers in the United States, and by 2025 will outnumber them more than 2 to 1. If expected demographic trends continue, the aging of the U.S. population will accelerate and the older population itself will have notably larger proportions in the highest age groups—75 to 84 and over 85.

Technologies that have increased life expectancy include advances in public hygiene and sanitation, reductions in infectious diseases, and continued improvement and accessibility of general health care. The OTA study broadly defines technology to include the development of knowledge and its application in solving societal problems. Technology thus ranges from biomedical research in the clinic to stair safety treads in the home.

Although the societal effects of technological change and the aging of the population are only partly foreseeable, likely possibilities are:

- Increasing prevalence of chronic diseases that can impair the older person's ability to function independently, especially as the proportions of those in the oldest subgroups increase.
- Growing need for social and health care services (i.e., long-term care) for chronic conditions and demand for medical care for treatment of acute illness.
- Significant changes in family structure, living arrangements, and housing, with more older persons living alone, and those over 55 more likely to have a very old living parent.
- A particular vulnerability of older workers to the impact of new production methods and workplace technologies, and changes in required work skills.

Recent advances have sharply reduced death rates among the elderly from heart disease and stroke, yet these remain the two leading killers. Today's most common disorders affecting elderly persons—chronic diseases—are those about which much less is known. OTA reviews five chronic conditions that have major impacts on the lives of older Americans: dementia, osteoarthritis, osteoporosis, hearing impairments, and urinary incontinence. Without greater efforts in biomedical research to discern causes, treatments, and preventive technologies for these conditions, the demand and costs for long-term care and supportive services will be greatly compounded.

Medication is effective in managing chronic conditions. Yet much remains unknown about the effects of individual drugs and, more importantly, combinations of drugs on the mental and physical health of older persons.

Behaviors that promote health and may prevent or delay the onset of various chronic diseases should be encouraged at even the oldest ages because their positive effects can be realized in relatively short time periods.

There is a need for a coordinated approach to long-term care and for improved technologies to assess the health and functional status of older persons. A wide range of options for supportive services and settings would more appropriately respond to the different needs of the elderly. Because Federal and State cost reimbursement policies influence the availability of health and long-term care services, changes in reimbursement criteria could promote such options.

Elderly persons have special housing needs. Federal policy has concentrated on construction and subsidies for elderly rental housing, but more attention is needed to coordinate community-based services with such housing programs. New technologies more easily allow single family units to be renovated for the elderly. Federal policies could encourage shared housing, accessory units, and other types of housing to expand the choices available.

Changes in workplace technologies may threaten job security in some industries, but in others they may improve performance, efficiency, and safety for many older workers, particularly the impaired. Telecommunications may enable older persons to take advantage of new home-based work arrangements. The retraining of older workers would encourage continued employment or provide new employment possibilities.

The development and application of technologies in all spheres of life will promote the independence of the elderly and enhance their ability to remain active and vital. American society will greatly benefit from the contributions that a healthy older population can contribute.

TECHNICAL MEMORANDA

Energy Technology Transfer to China

This technical memorandum presents preliminary findings on energy technologies from a major study which will examine the long-term commercial, political and security implications of technology transfer to China. The transfer of U.S. energy technology to China is of considerable benefit to both countries.

U.S.-Soviet Cooperation in Space

This technical memorandum concludes that valuable gains in science and space applications are possible through renewed cooperation between the countries; but obtaining these benefits calls for care and understanding in addressing other foreign policy and security concerns as well. Space cooperation can lead to substantive gains in some areas of space research and applications, and can provide the United States with improved insight into the Soviet space program and Soviet society as a whole.

Medical Devices and the Veterans Administration

This technical memorandum was prepared as part of OTA's assessment on *Federal Policies and the Medical Devices Industry* (released in October 1984).

OTA provides three different perspectives of the medical devices industry: that of the veteran as a consumer, that of the device industry as a supplier, and that of the VA as both a consumer and supplier. Topics addressed include the VA's programs in research and development, testing and evaluation, procurement and supply, and adoption and use of medical devices.

Review of the Public Health Services' Response to AIDS

By the end of 1984, approximately 7,000 cases of AIDS were reported in the United States; 40,000 new cases can be expected in the next 2 years, according to this technical memorandum. The main populations affected so far, in the United States, have been gay or bisexual men, intravenous drug abusers, recent immigrants from Haiti, and hemophilia patients. AIDS is also found in the rest of the Americas, in Europe, and in Africa.

Africa Tomorrow: Issues in Technology, Agriculture, and U.S. Foreign Aid

OTA concludes that the greatest potential for significantly expanding Africa's food production lies in increasing the productivity of small, subsistence-level farmers and herders, who raise most of Africa's food and yet have been largely ignored. The challenge is to devise research, extension, and aid programs that involve local people and integrate on-farm work into the larger framework of national and international efforts.

BACKGROUND PAPERS

Alternative Approaches to Cargo Policy

Because U.S. interests and negotiating strategies have not been defined, the United States has not generally accepted cargo policy. Foreign governments have adopted such policies, thus increasing the disadvantage of U.S. shipping interests and increasing the intensity of the debate over U.S. cargo policy.

R&D in the Maritime Industry

Problems identified with existing Federal maritime R&D include: difficulty with government contracting procedures, limited dissemination of R&D results, and restricted involvement of some sectors of the industry.

Human Gene Therapy

The main reason for attempting human gene therapy is that many severe genetic diseases are currently untreatable. There are 2,000 to 3,000 genetic diseases, and only a few can be treated using present medical technologies, according to OTA. Some of these might be aided by gene therapy.

CASE STUDIES

The Effectiveness and Costs of Continuous Ambulatory Peritoneal Dialysis (CAPD)

Continuous ambulatory peritoneal dialysis appears to be an acceptable alternative to hemodialysis for selected persons with end-stage renal disease. Analyzes the incentives that Medicare's reimbursement provides, and determines the cost differences between patients who remain on one system and those who change.

Technologies for Managing Urinary Incontinence

Describes the problems of urinary incontinence and its costs to the medical care system and society as a whole. The impact of Federal policies, particularly Medicare and Medicaid payment policy, on the kinds of technologies used and their effect on the quality of patients' lives is also discussed.

The Cost Effectiveness of Digital Subtraction Angiography in the Diagnosis of Cerebrovascular Diseases

DSA is a major technological advance in the field of diagnostic imaging radiography. Refinements in the basic technology are expected to increase its use in the diagnosis of cerebrovascular disease.

The Hemodialysis Equipment and Disposables Industry

In response to Medicare cost-containment pressures, the prices of hemodialysis equipment and disposables have decreased substantially in the past 5 years. The market for hemodialysis equipment grew rapidly when Medicare coverage was extended to ESRD patients. To save on costs, dialyzers labeled for single use are frequently reprocessed and reused. To protect ESRD patients, the Federal Government should ensure that dialyzers are adequately reprocessed and that quality control procedures are followed.

The Contact Lens Industry: Structure, Competition, and Public Policy

About 120 million people in the United States wear corrective eyeglasses and another 16 to 18 million use contact lenses, either exclusively or interchangeably with eyeglasses. Under the Medical Device Amendments of 1976, evidence of the safety and effectiveness of contact lenses must be presented to the U.S. Food and Drug Administration before lenses can be marketed. Small manufacturers have had difficulty in meeting these requirements because of the costs of such testing.

The Market for Wheelchairs: Innovations and Federal Policy

Although wheelchairs are essential to many disabled persons, the amount of money spent by the government for research and development on wheelchairs appears modest in relation to the number of users. The wheelchair market is dominated by third-party payers, such as Medicare, the Veterans Administration, and insurance companies.

The Boston Elbow

The Boston Elbow is an artificial arm that can be controlled by signals from an amputee's stump muscles. The adoption and use of the Boston Elbow has not been substantially impeded by the policies of the Veterans Administration, Medicare, or Workers' Compensation.

Intensive Care Units: Clinical Outcomes, Costs, and Decisionmaking

A number of steps concerning the provision of ICU care are outlined: modification of DRG payment for ICU, recognition by the legal system, research on the feasibility of developing predictors of short- and long-term survival to aid in treatment decisions, and encouraging health professionals to learn more about medical ethics and relevant legal obligations.

WORKSHOP PROCEEDINGS

Innovative Biological Technologies for Lesser Developed Countries

The participants of the workshop agreed that a range of promising, innovative technologies could help LDCs sustain soil fertility with reduced imputs but that these technologies are underused and many important ones are ignored. The technologies discussed include: underexploited plant resources, multiple cropping, agroforestry, azolla/algae symbiosis, underexploited animal species, zeolites, biological nitrogen fixation, and mycorrhizal fungi.

Technologies to Benefit Agriculture and Wildlife

Examines the opportunities and constraints to the application of technologies that benefit both agricultural production and wildlife conservation. It also identifies how the Farm Bill and other legislation can be changed to foster the integration of agriculture and wildlife interests.

SPECIAL REPORT

First Report on the Prospective Payment Assessment Commission

OTA's report covers the commission's first year of operation, focusing on ProPAC's procedures and functions. It discusses the commission's progress and contains questions that Congress may wish to analyze in the coming year.

Section III.—Work in Progress

More than 46 projects were in progress during fiscal year 1985, including 6 new studies.

This section lists the titles of assessments underway or in press, as of September 30, 1985. For a full description of these projects, please refer to the current "Assessment Activities," OTA-PC-105. This booklet may be obtained from OTA by calling OTA's Publication Request Line (202) 224-8996.

Energy, Materials, and International Security Division

Technology and the American economic transition

Energy and Materials Program
- Western surface mine reclamation
- High-technology ceramics and polymer composites

Industry, Technology, and Employment Program
- Technology and structural unemployment: reemploying displaced adults
- International competition in the service industries

International Security and Commerce Program
- Technology transfer to China
- Alternatives for improving NATO's defense response

Health and Life Sciences Division

Food and Renewable Resources Program
- Technology, public policy, and the changing structure of American agriculture
- Technologies to maintain biological diversity
- Integrated renewable resources management for U.S. insular areas
- Low resource agriculture in developing countries

Health Program
- Evaluation of agent orange protocol (mandated study)
- Status of biomedical research and related technology for tropical diseases
- Medicare's Prospective Payment System: strategies for evaluating cost, quality, and medical technology
- Technology and Indian health care: effectiveness, access, and efficiency
- Physician payment and medical technology under the Medicare Program
- Technologies for detecting heritable mutations

Biological Applications Program
- Alternatives to animal use in research, testing, and education
- Reproductive health hazards in the workplace
- Life-sustaining technologies and the elderly
- Disorders causing dementia

Science, Information, and Natural Resources Division

Communication and Information Technologies Program
- Automation and America's offices
- Federal Government information technology: congressional oversight and civil liberties
- Intellectual property rights in an age of electronics and information
- New communications technology: implications for privacy and security

Oceans and Environment Program
- Wastes in the marine environment: their management and disposal
- Technologies to control illegal drug traffic

Science, Education, and Transportation Program
- Hazardous materials transportation: technology issues

Section IV.—Organization and Operations

Created by the Technology Assessment Act of 1972 [86 Stat. 797], OTA is an agency of the legislative branch of the Federal Government (a copy of the Act is found in app. C, p. 116). OTA's primary function is to provide congressional committees with assessments or studies that identify the range of probable positive and negative consequences, social as well as physical, of policy alternatives affecting the uses of technology.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships of the applications of technology; identify alternative technological methods of implementing specific actions; identify alternative programs for achieving requisite goals; estimate and compare the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be necessary.

The act provides for a bipartisan congressional board, a director, and such other employees and consultants as may be necessary to conduct the Office's work. The congressional board is made up of six Senators, appointed by the President pro tempore of the Senate, and six Representatives, appointed by the Speaker of the House, evenly divided by party. In 1985, Sen. Ted Stevens (R-Alaska) and Cong. Morris Udall (D-Arizona) served as the Chairman and Vice Chairman, respectively, of the board. The two posts alternate between the Senate and House with each Congress. The board members from each House select their respective officer.

The congressional board sets the policies of the Office and is the sole and exclusive body governing OTA. The board appoints the director, who is OTA's chief executive officer and a nonvoting member of the board.

The act also calls for a Technology Assessment Advisory Council composed of 10 public members eminent in scientific, technological, and educational fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. The advisory council advises the board and the director on such matters as the balance, comprehensiveness, and quality of OTA's work, and OTA's nongovernmental resources.

Requests for OTA assessments may be initiated by:

- the chairman of any standing, special, select, or joint committee of Congress, acting alone, at the request of the ranking minority member, or at the request of a majority of the committee members;

- the OTA board; or
- the OTA Director, in consultation with the board.

The authorization of specific assessment projects and the allocation of funds for their performance is the responsibility of the OTA Board.

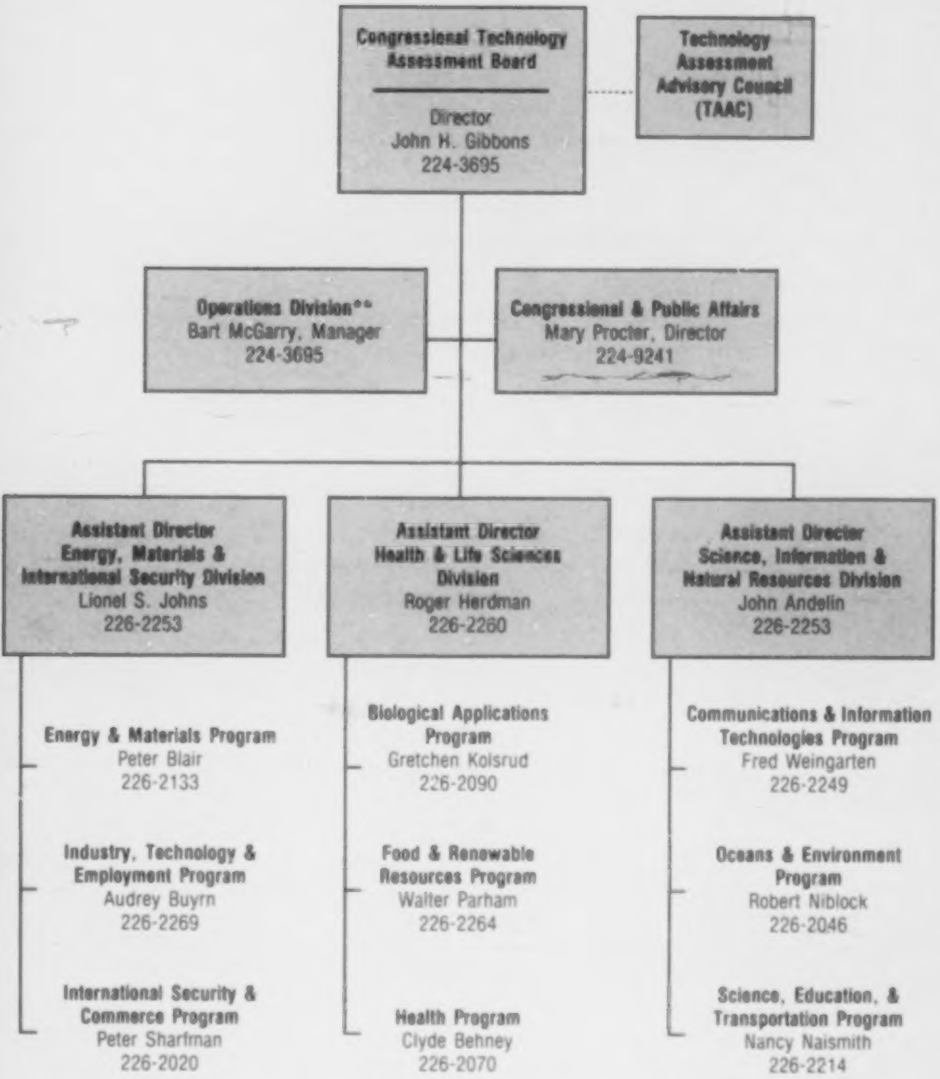
The Office is organized into three operating divisions, each headed by an assistant director. They encompass assessments grouped in the areas of energy and materials; international security and commerce; industry, technology, and employment; biological applications; food and renewable resources; health; communication and information technologies; oceans and environment; and science, education, and transportation. (See chart detailing OTA's organizational structure.)

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

The private sector is heavily involved in OTA studies as a source of expertise and perspectives. Contractors and consultants are drawn from industry, universities, private research organizations, and public interest groups.

OTA works to ensure that the views of the public are fairly reflected in its assessments. OTA involves the public in many ways—through advisory panels, workshops, and formal and informal public meetings. These interactions provide citizens with access to information and help OTA to remain sensitive to the full array of perspectives, not only of the recognized stakeholders, but also of technically trained and lay persons.

OTA* ORGANIZATION CHART


Congressional Technology Assessment Board
Director
John H. Gibbons
224-3695
Technology Assessment Advisory Council (TAAC)
Operations Division**
Bart McGarry, Manager
224-3695
Congressional & Public Affairs
Mary Procter, Director
224-9241
Assistant Director
Energy, Materials & International Security Division
Lionel S. Johns
226-2253
Assistant Director
Health & Life Sciences Division
Roger Herdman
226-2260
Assistant Director
Science, Information & Natural Resources Division
John Andelin
226-2253
Energy & Materials Program
Peter Blair
226-2133
Industry, Technology & Employment Program
Audrey Buyrn
226-2269
International Security & Commerce Program
Peter Sharfman
226-2020
Biological Applications Program
Gretchen Kolsrud
226-2090
Food & Renewable Resources Program
Walter Parham
226-2264
Health Program
Clyde Behney
226-2070
Communications & Information Technologies Program
Fred Weingarten
226-2249
Oceans & Environment Program
Robert Niblock
226-2046
Science, Education, & Transportation Program
Nancy Naismith
226-2214

---

*Located at 600 Pennsylvania Ave., S.E., Washington, DC.
- Publication requests—224-8996.
- Personnel locator—224-8713.

**Operations Division consists of the following units: Administrative Services, Budget and Finance Office, Information Center, Personnel Office, and Publishing Office.

OPERATIONS

Publishing Activities

During fiscal year 1985, OTA delivered 45 published documents to Congress. These included: 17 assessment reports, 2 special reports, 2 report supplements, 5 technical memoranda, 1 background paper, 8 health technology case studies, 2 workshop proceedings, and 8 administrative reports.

Requests for OTA Publications

During the period September 30, 1984, through October 1, 1985, OTA's Publishing Office received an average of 87 telephone and mail requests per day. Additional requests were processed by OTA program offices and the OTA Congressional and Public Affairs Office and are not included in the above statistics.

Private Sector Reprinting of OTA Publications

To date, 49 OTA publications have been reprinted (in whole or in part) by commercial publishers or private organizations. Among the reports reprinted during the fiscal year were:

- UNIPUB, Inc. (NY) reprinted the following: *Managing the Nation's Commercial High-Level Radioactive Waste* and *Preventing Illness and Injury in the Workplace;*
- Pergamon Press, Inc. (NY) reprinted the following: *Information Technology R&D: Critical Trends and Issues* and *Federal Policies and the Medical Devices Industry;*
- National Technical Information Service (VA) reprinted *Health Case Study 34: The Cost Effectiveness of Digital Subtraction Angiography in the Diagnosis of Cerebrovascular Disease.*

Sales of Publications

Government Printing Office.—Sales of OTA publications by the Superintendent of Documents continue to increase. In fiscal year 1985 the number of titles on sale was 160 and GPO sold 45,656 copies.

National Technical Information Service.—NTIS sells scientific reports and papers that are, generally, not in great demand but are useful for scientific researchers. NTIS is the outlet for OTA's assessment working papers and contractor reports, plus those reports that are out of print by GPO. During fiscal year 1985, NTIS sold 1,357 copies of OTA reports.

Organizational Roster of OTA Staff as of September 1985

OFFICE OF THE DIRECTOR

John H. Gibbons, *Director*
Sue Bachtel, *Executive Assistant*
Glenda Lawing, *Secretary*

Congressional and Public Affairs Office

Mary Procter, *Director, Congressional and Public Affairs*
Jean McDonald, *Press Officer*
Ellen Mika, *Assistant Press Officer*
Karen Piccione, *Administrative Assistant*
Eugenia Ufholz, *Congressional Relations Officer*

Medical Services

Rose McNair, *Resident Nurse*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Lionel S. Johns, *Assistant Director*
Beth Alexiou, *Division Assistant*

Technology and Economic Transition

Henry Kelly, *Senior Associate*
Linda Long, *Administrative Assistant*

Energy and Materials Program

Richard Rowberg, *Program Manager*
Peter Blair, *Senior Analyst*
Thomas Bull, *Senior Analyst*
Gregory Eyring, *Analyst*
Steve Plotkin, *Senior Analyst*
Pidge Quigg, *Administrative Assistant*
Jenifer Robison, *Senior Analyst*
Joanne Sedor, *Analyst*

International Security and Commerce Program

Peter Sharfman, *Program Manager*
Douglas Adkins, *Senior Analyst*
Eric Basques, *Analyst*
Jannie Coles, *Secretary*
Alan Crane, *Senior Associate*
Richard Dalbello, *Analyst*
Gerald Epstein, *Analyst*
Martha Harris, *Senior Analyst*
Tom Karas, *Senior Analyst*
Gordon Law, *Senior Analyst*
Nancy Lubin, *Analyst*
Dorothy Richroath, *Editorial Assistant*
Jacqueline Robinson, *Administrative Assistant*
Ray Williamson, *Senior Analyst*

Industry, Technology, and Employment Program

Audrey Buyrn, *Program Manager*
John Alic, *Senior Analyst*
Andrea Amiri, *Secretary*
Lance Antrim, *Senior Analyst*
Wendell Fletcher, *Senior Analyst*
Kitty Gillman, *Senior Analyst*
Julie Gorte, *Analyst*
Joel Hirschhorn, *Senior Associate*
Karen Larsen, *Senior Analyst*
Kirsten Oldenburg, *Analyst*
Edna Saunders, *Administrative Assistant*

HEALTH AND LIFE SCIENCES DIVISION

Roger Herdman, *Assistant Director*
Ogechee Koffler, *Division Assistant*
Kerry Kemp, *Division Editor*

Biological Applications Program

Gretchen Kolsrud, *Program Manager*
Robert Cook-Deegan, *Senior Analyst*
Gary Ellis, *Analyst*
Luther Val Giddings, *Analyst*
Robert Harootyan, *Analyst*
Catharine Maslow, *Research Analyst*
Lisa Raines, *Analyst*
Linda Rayford, *Secretary*
Sharon Smith, *Administrative Assistant*
Louise Williams, *Senior Analyst*

Food and Renewable Resources Program

Walter E. Parham, *Program Manager*
Patricia Durana, *Research Analyst*
Beckie Erickson, *Administrative Assistant*
Nellie Hammond, *Secretary*
Alison Hess, *Analyst*
Michael Phillips, *Senior Analyst*
Susan Shen, *Analyst*
Carolyn Swann, *Secretary*
Phyllis Windle, *Senior Analyst*

Health Program

Clyde J. Behney, *Program Manager*
Anne Kesselman Burns, *Analyst*
Virginia Cwalina, *Administrative Assistant*
Denise Dougherty, *Analyst*
Hellen Gelband, *Analyst*
Carol Guntow, *Secretary*
Diann Hohenthaner, *PC Specialist*
Cynthia King, *Analyst*
Larry Miike, *Senior Associate*
Gloria Ruby, *Senior Analyst*
Jane Sisk, *Senior Associate*
Judith Wagner, *Senior Analyst*

Special Projects

Michael Gough, *Senior Associate*
Karl Kronebusch, *Analyst*

SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION

John Andelin, *Assistant Director*
Doris Smith, *Division Assistant*
Paul Phelps, *Analyst*

Communication and Information Technologies Program

Rick Weingarten, *Program Manager*
Lauren Ackerman, *Research Analyst*
Prudence Adler, *Analyst*
Elizabeth Emanuel, *Administrative Assistant*
Karen Gamble, *Analyst*
Linda Garcia, *Analyst*
Shirley Gayheart, *Secretary*
Jennifer Nelson, *Research Assistant*
Priscilla Regan, *Analyst*
Zalman Shavell, *Senior Analyst*
Jean Smith, *Analyst*
Chuck Wilk, *Senior Analyst*
Fred Wood, *Senior Analyst*

Oceans and Environment Program

Robert Niblock, *Program Manager*
William Barnard, *Senior Analyst*
Kathleen Beil, *Administrative Assistant*
Thomas Cotton, *Senior Analyst*
James Curlin, *Senior Associate*
Robert Friedman, *Senior Analyst*
Joan Harn, *Analyst*
Peter Johnson, *Senior Associate*
Daniel Kevin, *Analyst*
Howard Levenson, *Analyst*
Jacqueline Mulder, *Secretary*
Paula Stone, *Senior Analyst*

Science, Education, and Transportation Program

Nancy Naismith, *Program Manager*
Phil Chandler, *Senior Analyst*
Marsha Fenn, *Administrative Assistant*
Eugene Frankel, *Senior Analyst*
Barry Holt, *Analyst*
Larry L. Jenney, *Senior Analyst*
Kathi Mesirow, *Analyst*
Edith Page, *Analyst*
Betty Jo Tatum, *Secretary*
Richard Thoreson, *Senior Analyst*

OPERATIONS DIVISION

Bart McGarry, *Operations Manager*
John Bell, *Senior Systems Integration Analyst*
Holly Gwin, *Management Analyst*

Administrative Services

Thomas P. McGurn, *Administrative Officer*
Maricel Quintana Baker, *Deputy Director of Contracts*

Alexandra Ferguson, *Director of Contracts*
Edith Franzen, *Conference Center Coordinator*
Bryan Harrison, *Office Automation Systems Analyst*

Budget and Finance Office

Catherine Henry, *Budget and Finance Officer*
Carolyn Harris, *Budget Assistant*
Frances Hemingway, *Budget and Finance Assistant*
Phil Jackson, *Management Information Systems Coordinator*
Jon Pressler, *Accounting and Budget Analyst*

Information Center

Martha Dexter, *Manager, Information Services*
Suzanne Boisclair, *Information Technician*
Vermille Davis, *Information Technician*
Leslie Fleming, *Information Technician*
Gail Kouril, *Assistant Manager, Information Services*

Personnel Office

William Norris, *Personnel Officer*
Lola Craw, *Personnel Specialist*
Denise DeSanctis, *Personnel Specialist*
Marsha Williams, *Administrative Assistant*

Publishing Office

Kathie S. Boss, *Publishing Officer*
John Bergling, *Graphic Designer/ Illustrator*
Debra Datcher, *Publishing Specialist*

Appendixes

Appendix A
Technology Assessment Advisory Council

The Technology Assessment Advisory Council (TAAC) was established by OTA's statute, and members are appointed by OTA's Congressional Technology Assessment Board (TAB). The Council advises TAB and the Director on issues and other matters related to science, technology, and technology assessment.

Members of TAAC on September 30, 1985, were:

William J. Perry, *Chairman*

Dr. Perry is managing partner of H&Q Technology Partners. Earlier in 1985 he was a managing director in the investment banking firm of Hambrecht & Quist, Inc. Prior to joining H&Q, he was the U.S. Under Secretary of Defense for Research and Engineering. He is a member of the National Academy of Engineering. Dr. Perry succeeded Dr. Kimball as TAAC Chairman in 1985.

David S. Potter, *Vice Chairman*

Dr. Potter retired as Vice President, Power Products and Defense Operations Group at General Motors in June 1985. He was formerly Assistant Secretary of the Navy for Research and Development and Under Secretary of the Navy. He is a member of the National Academy of Engineering.

Earl Beistline

Dr. Beistline is a private consultant in Fairbanks, Alaska. He is former Dean of the School of Mineral Industry, and also Former Provost of the University of Alaska.

Claire T. Dedrick

Dr. Dedrick is Executive Officer of the State Land Commission of California. She is a former member of the State of California Air Resources Board, a former California Public Utilities Commissioner, and has served as Secretary for Resources with The Resources Agency of the State of California.

James C. Fletcher

Dr. Fletcher is Whiteford Professor of Technology and Resources, University of Pittsburgh. He is former Administrator of NASA, President of the University of Utah, and Former Vice President for Systems at Aerojet General.

S. David Freeman

Mr. Freeman is currently a private consultant. He is former Chairman and member of the Board of the Tennessee Valley Authority. He has headed the energy policy staff of the President's Office of Science and Technology Policy; directed the Ford Foundation Energy Policy Project; and served as assistant to the Chairman of the Federal Power Commission.

Michel T. Halbouty

Mr. Halbouty is Chairman of the Board of Michel T. Halbouty Energy Co. in Houston, Texas. Prior to establishing his company, he was a chief geologist and petroleum engineer with Glenn H. McCarthy and also with Yount-Lee Oil Co.

Carl N. Hodges

Professor Hodges is Director of the University of Arizona Environmental Research Laboratory and Chairman of the Arizona Solar Energy Commission. He currently serves as a member of the National Academy of Sciences' Advisory Committee on Technology Innovation and as a member of the Arizona-Mexico Commission. Professor Hodges is a Fellow of the American Association for the Advancement of Science.

Rachel McCulloch

Dr. McCulloch is Associate Professor of Economics at the University of Wisconsin, on leave in 1985 at the Hoover Institution at Stanford University. She has served as a consultant to the Federal Reserve Board; is a former member of the U.S. Cabinet Task Force on Oil Import Control; and served as a member of the Presidential Commission on Industrial Competitiveness.

Lewis Thomas

Dr. Thomas is President Emeritus of the Memorial Sloan-Kettering Cancer Center and University Professor at the State University of New York at Stony Brook. He is a former member of the President's Biomedical Research Panel and of the President's Science Advisory Committee. Dr. Thomas is a distinguished lecturer and author in the medical field. He received the National Book Award in the arts and letters for his book, *Lives of a Cell*. Dr. Thomas is a member of the National Academy of Sciences and the Institute of Medicine.

Statutory Members

Charles A. Bowsher

Mr. Bowsher is Comptroller General of the United States and Director of the U.S. General Accounting Office.

Gilbert Gude

Mr. Gude is Director* of the Congressional Research Service, U.S. Library of Congress.

---

*Resigned as Director effective Oct. 1, 1985.

Appendix B
List of Advisors and Panel Members*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Technology and Economic Transition

Technology and the American Economic Transition Advisory Panel

David S. Saxon, *Chair*
Chairman of the Corporation
Massachusetts Institute of Technology

Claude Ballard
Partner
Goldman Sachs

William Baumol
Department of Economics
Princeton University

Harvey Brooks
Professor
Aiken Computation Laboratory
Division of Applied Sciences
Harvard University

Richard Crowder
Senior Vice President for Strategic Planning and Corporate Risk Officer
Pillsbury Co.

Judy Gregory
Research Associate
Department of Professional Employees
AFL-CIO

Henry Lichstein
Vice Chairman
Citibank

Mary Jo Manning
Partner
Wilkes, Artis, Hedrick, & Lane

Ray Marshall
Professor
LBJ School of Public Affairs
University of Texas

John J. McNamara
President
Young & Rubicam USA

Kathleen O'Reilly
Executive Director
Citizens Utility Board

Charles F. Sabel
Professor
Department of Science, Technology, and Society
Massachusetts Institute of Technology

George M. Scalise
Senior Vice President and Administrative Officer
Advanced Micro Devices

Albert Sobey
Director of Energy and Advanced Product Economics
General Motors Corp.

Barbara Starfield
Division of Health Policy
Johns Hopkins School of Hygiene and Public Health

Arthur G. Wirth
Department of Education
Washington University

Howard Young
Special Consultant to the President
United Auto Workers

Workshop: Manufactured Housing

Henry Collins
Vice President for Governmental Affairs
Underwriters Laboratories, Inc.

William M. Connolly
President
National Conference of States on Building Codes and Standards

Charles G. Field
Staff Vice President
Construction and Development and Regulatory Counsel
National Association of Home Builders

Ray J. Gans
Chairman, President, and CEO
The Commodore Corp.

---

*Affiliations are at time of appointment to panel or workshop.

David A. Harris
Vice President for Technology
National Institute of Building Sciences

Rick A. Howell
Director of Building Codes and
Regulatory Services
State of South Carolina

Gerald H. Jones
Director of Codes Administration
Kansas City, Missouri

Richard P. Kuchnicki
Executive Director
Council of American Building Officials

James Mitchell
President
Mitchell Brothers Contractors

Frank Walter
Vice President for Technical Activities
Manufactured Housing Institute

Stanley Warshaw
Director
Office of Product Standards Policy
National Bureau of Standards

Robert C. Wible
Executive Director
National Conference of States on
Building Codes and Standards, Inc.

Workshop: International Trade and Technology

Michael Aho
Senior Fellow—Economics
Council on Foreign Relations

Alice Amsden
Graduate School of Business
Administration
Harvard University

Peter Kenen
Professor
Princeton University

Hal Malmgren
Malmgren, Inc.

Laura Tyson
Department of Economics
University of California, Berkeley

Ray Vernon
Belfer Center
Kennedy School of Government

William Wallace
Senior Staff
Futures Group

Workshop: Provision of Information and Entertainment to Homes

Richard P. Adler
Director of TeleServices
Institute for the Future

Edmund R. Auer
President
CBS Software

Peter Broderick
Film and Video Production
Telecommunications Consulting

Red Burns
Alternate Media
New York University

Edward Catmulle
Computer Division
Lucas File LTD

Edward J. Cherian
Principal
Information Systems Inc.

William Coggshall
President
Software Access International

Barry Feinburg
Vice President of Research
The Warner Communications Record
Group

Leonard Feldman
Leonard Feldman Electronics
Laboratory

Frank Fisher
Senior Research Associate
The Urban Institute

Loise Galambos
Department of History
Johns Hopkins University

Bruce Guile
Fellow
National Academy of Engineering

Ronald Jurgen
Administrator
IEEE Spectrum

Michael Katz
President
EPYX

Peter Lemeiux
Consultant

Smith McKeithen
Vice President
Activision, Inc.

Robert V. Miller
Vice President
Market Vision Research, Inc.

Joe Murphy
Recreation Resources Division
National Park Service

David Peyton
Director of Government Relations
Information Industries Association

Peter Verhoven
Executive Director
Institute for Career and Leisure Development

Ken Wasch
Executive Director
Software Publishers Association

Louise Weiner
President
Cultural Services, Inc.

Workshop: The Future of the Recreation and Tourism Complex

Howard Bruns
President and Executive Officer
Sporting Goods Manufacturers Association, Inc.

Mack Bryant
Vice President
Recreational Vehicle Industry Association

Ken Cordell
Southeast Experiment Station
U.S. Forest Service
University of Georgia

Jack Ellis
Professor
Environmental Studies
Institute of Environmental Research
York University

Mel Goldberg
Melvin A. Goldberg, Inc.

Al Gomes
Senior Principal
Pannell Kerr Forster

John Graff
Executive Director
International Association of Amusement Parks and Attractions

David Humphreys
President
Recreational Vehicle Industry Association

Susan Mills
Director of Research and Information Service
National Restaurant Association

Patrick Phillips
Associate, Development Policy Research
The Urban Land Institute

Alan Pisarski
Transportation Consultant

John Robinson
Director, Survey Research
University of Maryland

Barry Tindall
Director of Public Affairs
National Recreation and Parks Association

Peter Verhoven
Executive Director
Institute for Career and Leisure Development

Louise Weiner
President
Cultural Services, Inc.

Energy and Materials Program

U.S. Natural Gas Availability Advisory Panel

William Vogely, *Chair*
Department of Mineral Economics
Pennsylvania State University

Marc Cooper
Research Consultant
Consumer Energy Council of America

Lloyd Elkins
Petroleum Consultant

Ed Erickson
Professor
Department of Economics and Business
North Carolina State University

Daniel Grubb
Vice President, Gas Supply
Natural Gas Pipeline Co.

John Haun
Professor of Geology
Colorado School of Mines

Donald Kash
Director
Science and Public Policy Program
University of Oklahoma

Harry C. Kent
Director
Potential Gas Agency
Colorado School of Mines

Lawrence Moss
Energy/Environmental Design and Policy Analysis

Roy E. Roadifer
Chief Geologist
Mobil Oil Corp.

Benjamin Schlesinger
Principal
Energy and Environment Division
Booz, Allen & Hamilton, Inc.

John C. Sharer
Assistant Director
Unconventional Natural Gas
Gas Research Institute

John Weyant
Deputy Director
Energy Modeling Forum
Stanford University

Ex Officio:
John Schanz
Senior Specialist in Energy Research Policy
Congressional Research Service
Library of Congress

New Electric Power Technologies: Problems and Prospects for the 1990s Advisory Panel

George Seidel, *Chair*
Chairman, Department of Physics
Brown University

Edward Blum
Vice President
Investment Banking Division
Merrill Lynch Capital Markets

Byron R. Brown
Consultant Manager
Engineering Service Division
Engineering Department
E. I. du Pont de Nemours & Co.

Bill D. Carnahan
General Manger
City of Fort Collins Light & Power

Mark Cooper
Research Director
Consumer Energy Council of America

Brian E. Curry
Director, Capacity Planning
Northeast Utilities

Janice G. Hamrin
Executive Director
Independent Energy Producers

William B. Harrison
Senior Vice President
Southern Co. Services, Inc.

Eric Leber
Director of Energy Research
American Public Power Association

Paul Maycock
President
Photovoltaic Energy Systems

Charles McCarthy
Vice President
Advanced Engineering
Southern California Edison

Anne F. Mead
Commissioner
New York State Public Service Commission

Alan Miller
Associate
World Resources Institute

Bruce W. Morrison
Vice President
Westinghouse Electric Corp.

Richard Nelson
Professor
Economics Department
Yale University

Fred Schweppe
Professor
Electrical Engineering Department
Massachusetts Institute of Technology

Jon Veigel
President
North Carolina Alternative Energy Corp.

Workshop: Regulatory Issues Affecting Developing Electric Generating Technologies

Sam Brown
Senior Vice President
Virginia Electric Power Co.

John E. Bryson
Executive Vice President
Southern California Edison Co.

George Knapp
Attorney
Nixon, Hargrove, Devans & Doyle

Therrell Murphy, Jr.
Vice President and Treasurer
Southern Company Services, Inc.

David Owens
Director, Rate Regulation Department
Edison Electric Institute

Elizabeth Ross
Attorney
Birch, Horton, Bittner, Pestinger and Anderson

Richard Schuler
Associate Professor
Department of Economics
Cornell University

Andrew Varley
Commissioner
Iowa Commerce Commission

Jon Wellinghoff
Consumer Advocate
Office of the Attorney General
State of Nevada

Western Surface Mine Reclamation

James J. Stukel, *Chair*
Vice Chancellor for Research & Graduate Dean
The Graduate College
University of Illinois at Chicago

George Davis
Senior Hydrogeologist
S. S. Papadopulos & Associates

Robert Flagg
Manager
Technical and Research Services
Mining and Reclamation Council of America

Tim Gallagher
Assistant Administrator
Energy Division
Montana Department of Natural Resources and Conservation

L. Thomas Galloway, Esq.
Galloway & Greenberg

Sheridan Glen
Assistant Vice President
Arch Mineral Corp.

Nick Golder
Consultant

Pat Holderness
Commissioner
Routt County, Colorado

Carolyn Johnson
Staff Geologist
Natural Resources Defense Council

Frank Kottlowski
Director
New Mexico Bureau of Mines and Mineral Resources

George Land
Director, Technology Assessment
AMAX Coal Co.

Cyrus McKell
Vice President, Research
Native Plants, Inc.

Lyle Randen
Administrator, Land Quality Division
Wyoming Department of Environmental Quality

Patrick Sweeney
Regional Director
Western Organization of
Resource Councils

Lauri M. Zell
Director, Government Affairs
Mining and Reclamation
Council of America

Ex Officio:
Marlene Berg
Division of Ecological Services
Fish and Wildlife Service
U.S. Department of the Interior

Dan Kimball
Environmental Protection Specialist
Air and Water Quality Division
National Park Service

Al Klein
Administrator, Western Technical Center
Office of Surface Mining
U.S. Department of the Interior

High-Technology Ceramics and Polymer Composites Advisory Board

Rodney W. Nichols, *Chair*
Executive Vice President
The Rockefeller University

Robert Buffenbarger
Chairman, Bargaining Committee
G.E. Aircraft Engine Group
International Association of Machinists

Joel Clark
Associate Professor of Materials
Systems
Director of Materials Systems
Laboratory
Massachusetts Institute of Technology

Laimonis Embrekts
Vice President
Manufacturing and Engineering

Samuel Goldberg
President
INCO-US Inc.

Sheldon Lambert
Senior Vice President
LTV Corp.

James W. Mar
Director, Technology Laboratories for
Advanced Composites
Department of Aeronautics
Massachusetts Institute of Technology

Arthur F. McLean
Manager, Ceramics Research
Ford Motor Co.

Joseph Panzarino
Director, Research and Development
Advanced Ceramics
Norton Co.

Norman L. Peterson
Group Leader and Senior Scientist
Materials Science and Technology
Argonne National Laboratories

Dennis W. Readey
Chairman
Ceramics Engineering Department
Ohio State University

B. Walter Rosen
President
Materials Science Corpo.

Amy L. Walton
Member, Technical Staff
Jet Propulsion Laboratory

Alvin S. Weinstein
Professor
Department of Engineering and Public
Policy
Carnegie Mellon University

Dick Wilkins
Staff Specialist
Structures and Design Department
Fort Worth Division
General Dynamics Corp.

Workshop: Materials R&D

Arden L. Bement, Jr.
Vice President, Technical Services
TRW Inc.

H. Kent Bowen
Professor
Ceramic and Electrical Engineering
Massachusetts Institute of Technology

William F. Brinkman
Vice President, Research
Sandia National Laboratories

Morris Cohen
Professor
Department of Materials, Science, and
Engineering
Massachusetts Institute of Technology

George Dieter
Dean of Engineering
University of Maryland

Dean Eastman
T.J. Watson Research Center
IBM Corp.

Serge Gratch
Director, Vehicle and Powertrain Component Research Lab
Ford Motor Co.

Kenneth L. Kliewer
Associate Director for Physical Research
Argonne National Laboratory

Tom Moss
Dean, Graduate Studies
Case-Western University

James Mueller
Department of Materials Science and Engineering
University of Washington

William Nix
Department of Materials Science and Engineering
Stanford University

Rudolph Pariser
Director, Polymer Science
Central Research & Development Department
E.I. du Pont de Nemours & Co., Inc.

William Slichter
Executive Director, Research
Materials Science Engineering Division
AT&T Bell Laboratories

Morris Steinberg
Vice President, Science
Lockheed Corp.

J.E. Werner
Director of Technology Transfer and Ventures
Bethlehem Steel Corp.

Workshop: Fine Ceramics

Dennis Ready, *Chair*
Chairman
Ceramics Engineering Department
Ohio State University

Charles Amann
Head, Engine Research Department
GM Research Laboratories

Robert Katz
Chief, Ceramics Research Division
Army Materials and Mechanics Research Center

William R. Prindle
Director of Materials Research
Corning Glass Works

Roy Rice
Director of Materials Research
W.R. Grace & Co.

David Richerson
Supervisor, Advanced Materials
Garrett Turbine Engine Co.

Workshop: Composites

Robert Kaiser
Consultant
Argos Associates, Inc.

Seymour Newman
Senior Staff Scientist
Plastics Development and Applications
Ford Motor Co.

Ben Wilcox
Assistant Director
Materials Science Division
Defense Advanced Research Projects Agency

Carl Zweben
Advanced Technology Manager
Space Systems Division
General Electric Co.

International Security and Commerce Program

Command, Control, Communications, and Intelligence Systems (C^3I) Advisory Panel

John S. Toll, *Chair*
President
University of Maryland

Lew Allen, Jr.
General, USAF (retired)
Director
Jet Propulsion Laboratory

Al Babbitt
Vice President and General Manager
Command Systems
IBM Corp.

Neil Birch
President
Birch Associates, Inc.

Gerald Dinneen
Vice President
Science and Technology
Honeywell

Robert R. Everett
President
The Mitre Corp.

Edward Goldstein
Assistant Vice President
Financial Management
AT&T Co.

Arnold Horelick
The Rand Corp.

William Kaufman
Professor
Department of Political Science
Massachusetts Institute of Technology

Glenn Kent
Lt. General, USAF (retired)
The Rand Corp.

Isaac C. Kidd, Jr.
Admiral, USN (retired)

Kostas J. Liopiros
Consultant

William Perry
Managing Partner
Hambrecht & Quist

Jack Ruina
Professor
Department of Electrical Engineering
Massachusetts Institute of Technology

Brent Scrowcroft
Lt. General, USAF (retired)

Walter Slocombe
Attorney
Kaplan & Drysdale

Leon Sloss
President
Leon Sloss Associates

John D. Steinbruner
Director
Foreign Policy Studies Program
The Brookings Institution

John Stenbit
Vice President
Requirements & Group Development
TRW Defense Systems Group

Jerome B. Wiesner
President Emeritus
Massachusetts Institute of Technology

International Cooperation and Competition in Civilian Space Activities Advisory Panel

Paul Doty, *Chair*
Director, Center for Science and International Affairs
Harvard University

Benjamin Bova
President
National Space Institute

Robert Evans
Principal of Venture Capital
Hambrecht & Quist, Inc.

Robert A. Frosch
Vice President, Research
General Motors Research Laboratories

Eilene Galloway
Honorary Director
International Institute of Space Law
International Astronautical Federation

Mireille Gerard
Administrator, Corporate and Public Programs
American Institute of Aeronautics and Astronautics

Ivan Getting
President Emeritus
The Aerospace Corp.

Benjamin Huberman
Vice President
Consultants International Group Inc.

John Mayo
Vice President
Bell Laboratories

Walter McDougall
Associate Professor of History
University of California, Berkeley

John L. McLucas
Executive Vice President
2d Chief Strategic Officer
Communications Satellite Corp.

Martin Menter
Attorney
Washington, DC

Arthur Morrissey
Director, Future Systems
Martin Marietta Aerospace

Fred Raynes
Vice President
Grumman International Inc.

Gary Saxonhouse
Professor of Economics
University of Michigan

Jerome Simonoff
Vice President
CitiCorp Industrial Credit, Inc.

Leonard Sussman
Executive Director
Freedom House

John Townsend
President
Fairchild Space & Electronics Co.

Laurel Wilkening
Vice Provost
University of Arizona

Elizabeth Young
Vice President
Marketing and Sales
COMSAT General Corp.

New Ballistic Missile Defense Technologies Advisory Panel

Guyford Stever, *Chair*
President
Universities Research Associates

Solomon Buchsbaum
Executive Vice President
Customers Systems
AT&T Bell Laboratories

Ashton Carter
Assistant Professor of Public Policy
Assistant Director, Center for Science
and International Affairs
John F. Kennedy School of Government
Harvard University

Robert Clem
Director of Systems Sciences
Sandia National Laboratories

Sidney D. Drell
Deputy Director
Stanford Linear Accelerator Center

Daniel Fink
President
D. J. Fink Associates Inc.

Richard L. Garwin
IBM Fellow
Thomas J. Watson Research Center
IBM Corp.

Noel Gayler
Admiral, U.S. Navy (retired)
American Committee on
East-West Accord

Colin Gray
President
National Institute for Public Policy

George Jeffs
President
North American Space Operations

David Jones
General, U.S. Air Force (retired)

Michael M. May
Associate Director at Large
Lawrence Livermore National Laboratory

Robert S. McNamara
Former Secretary of Defense

H. Alan Pike
Program Manager
Space Stations
Lockheed Missiles & Space Co.

Frederick Seitz
President Emeritus
The Rockefeller University

Robert Selden
Associate Director for Theoretical and
Computation Physics
Los Alamos National Laboratory

Marshall D. Shulman
Director, Harriman Institute for
Advanced Study of the Soviet Union
Columbia University

Gerard C. Smith
President
Consultants International Group, Inc.

Sayre Stevens
Vice President
System Planning Corp.

John Toomay
Major General, U.S. Air Force (retired)

Seymour Zeiberg
Vice President
Research and Engineering Operations
Martin Marietta Aerospace

Workshop: Soviet Ballistic Missile Defense Policies

Raymond L. Garthoff
Senior Fellow
The Brookings Institution

Daniel Goure
Director
Center for Soviet Studies
Science Applications International Corp.

David Holloway
Center for International Security and Arms Control
Stanford University

Stephen M. Meyer
Center for International Studies
Massachusetts Institute of Technology

Harriet F. Scott
Consultant in Soviet Studies

Edward Warner
Senior Social Scientist
The Rand Corp.

Technology Transfer to China Advisory Panel

Robert Dernberger, *Chair*
East-West Resource Systems Institute

A. Doak Barnett
School for Advanced International Studies
The Johns Hopkins University

Peter Carlson
Chief Scientist
Crop Genetics International

Gareth Chang
Vice President
McDonnell Douglas Corp.

Chauncey Chu
Vice President of Manufacturing
Wang Laboratories, Inc.

Bo Denysyk
IBM Corp.

Basil K. Fox
Vice President
Bechtel China Inc.

S. David Freeman
Attorney
Gordon and Thomas Attorneys

Thomas Hayward
Admiral, U.S. Navy (retired)
Hayward Associates

Richard Holton
School of Business Administration
University of California, Berkeley

Morton Kaplan
Department of Political Science
University of Chicago

Arthur A. Klauser
Senior Vice President
Mitsui & Co. (USA) Inc.

Stanley Lubman
Attorney
Heller, Ehrman, White & Macauliffe

Charles Lucy
Director, International Operations
Corning Glass Works

Bruce Lusingnan
Professor
Electrical Engineering Department
Stanford University

William Parrish
Professor
Center for Far Eastern Studies

Vaclav Smil
Professor
Department of Geography
University of Manitoba

Roger Sullivan
Executive Vice President
National Council for U.S. China Trade

Leonard Unger
Fletcher School of Law and Diplomacy
Tufts University

Workshop: Energy Technology Transfer to China

Allen S. Whiting, *Chair*
Department of Political Science
University of Arizona

Kenneth Angell
China Affairs
Overseas Private Investment Corp.

Baruch Boxer
Department of Human Ecology
Cook College
Rutgers University

Hugh Donaghue
Senior Vice President
Control Data Corp.

Warren Donnelly
Senior Specialist
Congressional Research Service

Thomas Fingar
Senior Research Associate
Northeast Asia United States Forum on International Policy
Stanford University

Wendy Frieman
Director, Asia Technology Program
Science Applications International Corp.

Ronnie Lee Goldberg
Vice President
International Business
New York Chamber of Commerce and Industry

Dixon Hoyle
Vice President, International Business
Westinghouse Electric Corp.

Richard L. Hughes
Executive Vice President
Fluor China Inc.

Eric Larson
Centr for Energy and Environmental Studies
Princeton University

Kenneth Lieberthal
Center for Chinese Studies
University of Michigan

Jonathan D. Pollack
Political Science Department
The Rand Corp.

Thomas W. Robinson
Professor
Department of Government
Georgetown University

Cathy Ruckleshaus
China Affairs
Overseas Private Investment Corp.

Denis Fred Simon
Sloan School of Management
Massachusetts Institute of Technology

Leonard Spector
Senior Associate for International Peace
Carnegie Endowment

Roger Sullivan
Executive Vice President
National Council for U.S.-China Trade

Richard Peter Suttmeier
Department of Government
Hamilton College

Amy Wilson
Committee on Scholarly Communication with the PRC
National Academy of Sciences

Kim Woodard
President
China Energy Ventures, Inc.

Industry, Technology, and Employment Program

Strategic Materials: Technologies To Reduce U.S. Import Vulnerability Advisory Panel

Walter S. Owen, *Chair*
Professor of Materials Science
Massachusetts Institute of Technology

Arden Bement
Vice President, Technical Resources
TRW, Inc.

Edwin Clark
Senior Associate
Conservation Foundation

Tom Clough
Director of Technology
Atlantic Richfield Co.

Robert G. Dunn
Senior Vice President
AMAX Metals Group

Robert Ellsworth
President
Robert Ellsworth & Co.

Michael E. Fisher
Professor of Chemistry, Physics and Mathematics
Cornell University

Herbert H. Kellogg
Professor of Extractive Metallurgy
Columbia University

Hans Landsberg
Senior Fellow
Resources for the Future

Jessica Tuchman Mathews
Vice President
World Resources Institute

William A. Owczarski
Manager, Technical Planning
Pratt & Whitney Aircraft Group

R. Byron Pipes
Director, Center for Composite Materials
University of Delaware

R. K. Pitler
Senior Vice President and Technical Director
Allegheny-Ludlum Research Center

Dennis W. Readey
Chairman
Ceramics Engineering Department
Ohio State University

James K. Sebenius
Assistant Professor
John F. Kennedy School of Government
Harvard University

Albert Sobey
Director, Energy Economics
General Motors Corp.

Alex Zucker
Associate Director
Oak Ridge National Laboratory

Superfund Strategy Advisory Panel

Martin Alexander, *Chair*
Department of Agronomy
Cornell University

K. W. Brown
Professor
Soil and Crop Sciences
Texas A&M University

Morton Corn
Professor and Director
Division of Environmental Health Engineering
School of Hygiene and Public Health
The Johns Hopkins University

Bonnie L. Exner
Consultant
Governor's Lowry Landfill Monitoring Committee
State of Colorado

Ted Greenwood
Associate Professor of Political Science
Institute of War and Peace Studies
Columbia University

Linda E. Greer
Science Associate
Environmental Defense Fund

Robert G. Kissell
Senior Consultant, Engineering Department
E. I. du Pont de Nemours & Co.

Gary E. Kovall
Manager, Environmental, Legislative and Regulatory Affairs
ARCO Petroleum Products Co.

Stephen U. Lester
Consultant
Citizens Clearinghouse for Hazardous Waste

Adeline G. Levine
Professor
Department of Sociology
State University of New York at Buffalo

Randy M. Mott
Attorney
Breed, Abbott & Morgan

Norman H. Nosenchuck
Director
Division of Solid and Hazardous Waste
New York State Department of Environmental Conservation

James T. O'Rourke
Senior Vice President, Industrial Group
Camp Dresser & McKee, Inc.

James W. Patterson
Professor and Chairman
Pritzker Department of Environmental Engineering
Illinois Institute of Technology

Robert Repetto
Senior Associate
World Resources Institute

Bernard L. Simonsen
Vice President, Administration
IT Corp.

William A. Wallace
Director
Solid and Hazardous Waste Management
CH2M HILL

Workshop: Superfund

Lowell C. Bowie
President
RoTech, Inc.

Jimmy Boyd
Marketing
J.M. Huber Corp.

P. Frank Budininkas
Manager
Chemical and Environmental Systems
GARD Division, Chamberlain Manufacturing

Louis Flax
President
Lopat Enterprises

Linda Jones
Division of Environmental Quality
Department of Natural Resources
State of Missouri

Michael Modell
Director
Regulatory Management
Monsanto Co.

Greg Peterson
CH2M HILL

Stanley Sojka
Manager
Enviromental Technology
Occidental Chemical Corp.

Theodore Taylor
NOVA, Inc.

Technology and Structural Unemployment: Retraining Adult Displaced Workers: Advisory Panel

Joseph Weizenbaum, *Chair*
Professor
Department of Electrical Engineering and Computer Science
Massachusetts Institute of Technology

Kathy Alessandro
Program Design Coordinator
Downriver Community Conference

Paul Barton
Liaison, Assessment Policy Committee
National Assessment of Educational Progress

Marc Bendick
Senior Research Associate
The Urban Institute

Paul Boyer
Professor
History Department
University of Wisconsin-Madison

Dennis C. Carey
Director
State and Local Government Consulting
Hay Associates

Dick Greenwood
Special Assistant to the International President
International Association of Machinists and Aerospace Workers

Donald Hancock
Professor
Department of Political Science
Vanderbilt University

Carol Hollenshead
Director of Administrative Services, Planning, and Development
School of Nursing
The University of Michigan

Robert Karasek
Professor
Department of Industrial and Systems Engineering
University of Southern California

Sar Levitan
Director
Center for Social Policy Studies
The George Washington University

Robert Machin
Senior Vice President
Alliance Mortgage Co.

Jill Miller
Executive Director
Displaced Homemakers Network

Iles Minoff
Program Specialist
Human Resources Development Institute

Ronnie Straw
Development and Research Director
Communications Workers of America

Burdette G. Taylor
Education Program Manager
IBM Corp.

Vi Traynor
Manager, Mid-West Region
American Electronics Association

Elizabeth Useem
Professor
Department of Sociology
University of Massachusetts—Harbor Campus

Gary Wuslich
Director, Participative Programs
LTV Steel Co.

International Competition in the Service Industries Advisory Panel

Robert Gilpin, *Chair*
Woodrow Wilson School of Public and International Affairs
Princeton University

C. Michael Aho
Senior Fellow-Economics
Council on Foreign Relations, Inc.

Mark Anderson
Economist
Department of Economic Research
AFL-CIO

John Bowles
President
Public Policy Analysis, Inc.

Robert B. Cohen
Special Consultant on High Technology Economic Development Programs
New York State Urban Development Corp.

Richard L. Crandall
President and CEO
Comshare

Ronnie L. Goldberg
Vice President
International Business
New York Chamber of Commerce and Industry

Rob Kling
Department of Information and Computer Science
University of California, Irvine

George Kohl
Research Economist
Development and Research Department
Communications Workers of America

Stephen D. Krasner
Department of Political Science
Stanford University

Robert Kuttner
Economics Writer

Martin Mayer
Author

William Nolen
Senior Vice President
Brown & Root, Inc.

Hugh O'Donnell
Senior Vice President
Crocker National Bank

K. Nagaraja Rao
Vice President for Research
Wentworth Institute of Technology

Cathy A. Schoen
Research Director
Service Employees International Union

Jeffrey J. Schott
Visiting Fellow
Institute for International Economics

Ronald K. Shelp
Vice President for Public Policy
Celanese Corp.

Joan E. Spero
Senior Vice President
American Express Co.

Workshop: Section 3 of the Federal Coal Leasing Act Amendments

Sandra Blackstone
College of Law
University of Denver

Karl Gawell
Legislative Representative
National Wildlife Federation

Bill Grant
Manager, Government Affairs
Utah International, Inc.

Lawrence G. McBride
Assistant Solicitor for Onshore Minerals
U.S. Department of the Interior

Harry Moritz
Chief, Branch of Technical Support
Solid Minerals Operations Division
Bureau of Land Management
U.S. Department of the Interior

Dianne Nielson
Division of Oil, Gas, and Mining
State of Utah

Lynn Walker
Mobil Corp.

Geoff Webb
Washington Director
Friends of the Earth

Warren White
Office of the Governor
State of Wyoming

Brooks Yeager
Washington Representative
Sierra Club

HEALTH AND LIFE SCIENCES DIVISION

Biological Applications Program

Technology and Aging in America Advisory Panel

Robert Binstock, *Chair*
Henry R. Luce Professor of Aging, Health, and Society
School of Medicine
Case Western Reserve University

Ray Bartus
Group Leader of Geriatrics
Medical Research Division
Lederle Laboratories
American Cyanamid Company

Robert Berliner
Dean
School of Medicine
Yale University

Robert Butler
Chairman, Department of Geriatrics and Adult Education
Mt. Sinai Medical Center

Robert Clark
Associate Professor
Department of Economics and Business
North Carolina State University

Lee Davenport
Senior Vice President and Chief Scientist (retired)
GTE Corp.

Ken Dychtwald
President
Dychtwald & Associates

Caleb Finch
Professor
Biological Sciences and Gerontology
Andrus Gerontology Center
University of Southern California

Velma Murphy Hill
Director
Civil and Human Rights Division
Service Employees International Union

Robert L. Kane
Senior Researcher
The Rand Corp.

Paul A. Kerschner
Associate Director for Programs, Legislation and Development
American Association of Retired Persons

Maggie Kuhn
Founder and National Convener
Gray Panthers

Matt Lind
Vice President
Corporate Planning and Research
The Travelers Insurance Co.

Robert G. Lynch
Vice President, Marketing Planning
GTE Corp.

Mathey D. Mezey
Director
Teaching Nursing Home Program
University of Pennsylvania

Hamish Munro
Professor of Medicine and Nutrition
Human Nutrition Research Institute
Tufts University

Bernice Neugarten
Professor of Education and Sociology
Northwestern University

Sara Rix
Director of Research
The Women's Research and Education Institute

Pauline Robinson
Research Professor of Gerontology
Andrus Gerontology Center
University of Southern California

John Rowe
Chief of Geriatrics
Beth Israel Hospital

Bert Seidman
Director
Department of Occupational Safety, Health and Social Security
AFL-CIO

Jacob Siegel
Senior Researcher
Center for Population Research
Georgetown University

Alternatives to Animal Use in Testing and Experimentation Advisory Panel

Arthur L. Caplan, *Chair*
Associate Director for the Humanities
Hastings Center

Perrie M. Adams
Associate Dean for Research
Health Science Center
University of Texas at Dallas

Melvin Balk
Vice President and Scientific Director
Charles River Breeding Laboratories, Inc.

Earle W. Brauer
Vice President, Medical Affairs
Revlon Research Center

David J. Brusick
Director
Molecular Sciences Directorate
Litton Bionetics

G. Gilbert Cloyd
Director, Product Development
Norwich Eaton Pharmaceuticlas, Inc.

W. Jean Dodds
Division of Laboratories and Research
New York State Department of Health

Kurt Enslein
President
Health Designs, Inc.

Alan M. Goldberg
Director, The Johns Hopkins Center for Alternatives to Animal Testing

Richard M. Hoar
President and Scientific Director
Findley Research, Inc.

Peter Barton Hutt
Attorney
Covington & Burling

Connie Kagan
Chair
Animal Political Action Committee

Ronald Lamont-Havers
Director, Research Administration
Massachusetts General Hospital

John E. McArdle
Director, Laboratory Animal Welfare
Humane Society of the United States

Robert A. Neal
President
Chemical Industry Institute of Toxicology

J. Wesley Robb
Professor
School of Religion, and School of Medicine
University of Southern California

Andrew N. Rowan
Assistant Dean for New Programs
School of Veterinary Medicine
Tufts University

Jeri Sechzer
Associate Professor
Bourn Research Laboratory, New York Hospital
Cornell Medical Center

Henry Spira
Director
Coalition to Abolish the LD_{50} and Draize Tests

Reproductive Health Hazards in the Workplace Advisory Panel

Ruth Faden, *Chair*
Associate Professor
Department of Health Services Administration
The Johns Hopkins University

Joan E. Bertin
Associate Director
Women's Rights Project
American Civil Liberties Union

Larry L. Ewing
Division of Reproductive Biology
School of Hygiene and Public Health
The Johns Hopkins University

Ronald D. Hood
Professor
Biology Department
The University of Alabama

Vilma R. Hunt
Professor, Environmental Health
Program in Science, Technology, and Society
Massachusetts Institute of Technology

Larry Johnson
Assistant Professor
Department of Cell Biology
Health Science Center
University of Texas at Dallas

Norman W. Klein
Professor
Department of Animal Genetics
University of Connecticut

James E. Lockey
Director, Occupational Medical Clinic
Rocky Mountain Center for Occupational and Environmental Health
University of Utah Medical Center

David C. Logan
Clinical Toxicologist
Corporate Medical Department
Mobil Oil Corp.

Junius C. McElveen, Jr.
Attorney
Jones, Day, Reavis & Pogue

Mary-Win O'Brien
Assistant General Counsel
United Steelworkers of America

Neena B. Schwartz
Professor
Department of Neurobiology and Physiology
Northwestern University

Judith A. Scott
Associate General Counsel
United Mine Workers of America

Margaret Seminario
Associate Director
Department of Occupational Safety, Health, and Social Security
AFL-CIO

Robert C. Spear
Department of Biomedical and Environmental Health Sciences
School of Public Health
University of California, Berkeley

M. Anne Spence
Professor
Division of Medical Genetics
Neuropsychiatric Institute
Center for Health Sciences
University of California, Los Angeles

R. E. Staples
Staff Teratologist
Haskell Laboratory for Toxicology and Industrial Medicine
E. I. du Pont de Nemours & Co.

Jeanne M. Stellman
Associate Professor
School of Public Health
Columbia University

John R. Wheeler
Attorney
Standard Oil Co. (Indiana)

Consultant to the Panel:
Michael S. Baram
Attorney
Brocken and Baram

Disorders Causing Dementia Advisory Panel

Daniel Wikler, *Chair*
Professor
Program in Medical Ethics
Departments of Philosophy and History of Medicine
University of Wisconsin Medical School

John P. Blass
Director
Dementia Research Service
Burke Rehabilitation Center, and
Professor of Medicine and Neurology
Cornell University Medical College

Stanley J. Brody
Professor
Department of Physical Medicine and Rehabilitation
University of Pennsylvania Medical School, and Wharton School of Finance

Donna Campbell
Clinical Coordinator
Geriatric Research and Education and Care Center
Veterans' Administration

Gill Defor
Attorney
National Senior Citizens Law Center

Karl M. Girshman
Administrator
Hebrew Home of Greater Washington

Lisa P. Gwyther
Director
Center for the Study of Aging and Human Development
Family Support Program
Duke University Medical Center

Thomas Jaswiecki
Chief, Long-Term Care Section
American Health Care Association

Purlaine Lieberman
State Relations Director
Equitable Life Assurance Society of the United States

William R. Markesbery
Professor of Pathology and Neurology
University of Kentucky College of Medicine

Paul S. Nathanson
Professor of Law, and
Director, Institute of Public Law
University of New Mexico

Nancy K. Orr
Director
Hillhaven Corporation Special Care Units

Dominick P. Purpura
Dean
Albert Einstein College of Medicine

Betty R. Ransom
Director, National Institute on Adult Daycare, and National Institute on the Rural Elderly
National Council on the Aging

Donald P. Schneider
Associate Professor
Director, Management Health Systems
School of Management
Renssalaer Polytechnic Institute

Jerome Stone
President
Alzheimer's Disease and Related Disorders Association

Sallie Tisdale
Author

Ramon Valle
Professor
School of Social Work
College of Human Services
San Diego State University

Philip Weiler
Director, Center for Aging and Health
Professor, Department of Community Health
School of Medicine
University of California at Davis

Peter Whitehouse
Assistant Professor
Departments of Neurology and Neuroscience
The Johns Hopkins University School of Medicine

Life-Sustaining Technologies and the Elderly Advisory Panel

John W. Rowe, *Chair*
Chief, Gerontology Division
Department of Medicine
Beth Israel Hospital

David Axelrod
Commissioner of Health
New York State Department of Health

Abraham Brickner
Director, Health Services Research and Program Development
The Cleveland Clinic Foundation

Daniel J. Callahan
Director
The Hastings Center

A. Edward Doudera
Doudera/Wenzel Productions

Nancy N. Dubler
Department of Epidemiology and Social Medicine
Montefiore Medical Center

David M. Eddy
Professor and Director
Center for Health Policy Research and Education
Duke University

Rose Goldstein
Director of Social Services
Jewish Home and Hospital for the Aged

Val J. Halamandaris
President
National Association for Home Care

William A. Knaus
Director of I.C.U. Research
School of Medicine
George Washington University

Steven Lazarus
Senior Vice President
Baxter Travenol Laboratories, Inc.

Joanne Lynn
Assistant Professor of Health Care Services
Division of Geriatric Medicine
George Washington University Medical Center

Catherine P. Murphy
Associate Professor and Chairperson
Graduate Program
Department of Nursing
Graduate School of Arts and Science
Boston College

John J. Paris
Associate Professor
Department of Religious Studies
Holy Cross College

A.J. Rock-Levinson
Executive Director
Concern for Dying

Anne Scitovsky
Chief, Health Economics Department
Research Institute
Palo Alto Medical Foundation

Victor W. Sidel
Distinguished University Professor of Social Medicine
Montefiore Medical Center
Albert Einstein College of Medicine

R. Knight Steel
Professor of Medicine
Geriatrics Section
Boston University Medical Center

William A. Wendt
Executive Director and Founder
The St. Francis Center

Terrie T. Wetle
Assistant Professor of Medicine
Division of Health Policy
Harvard University

Mary Opal Wolanin
Professor Emerita
University of Arizona

Workshop: Surrogate Decisionmaking

Elias S. Cohen, *Chair*
Vice President
Community Services Institute, Inc.

Thomas L. Beauchamp
Senior Research Assistant
Kennedy Institute of Ethics
Georgetown University

Richard W. Besdine
Director, Gerontological Education
Hebrew Rehabilitation Center for Aged

Dorothy H. Coons
Institute of Gerontology
University of Michigan

Ronald E. Cranford
Associate Physician in Neurology
Department of Neurology
Hennepin County Medical Center

Anne J. Davis
Professor of Nursing
Department of Mental Health and Community Nursing
University of California, San Francisco

Daniel C. Dennett
Distinguished Arts and Science Professor
Department of Philosophy
Tufts University

Nancy Neveloff Dubler
Director, Division of Legal and Ethical Issues in Health Care
Department of Epidemiology and Social Medicine
Montefiore Medical Center

Bernard Lo
Assistant Professor of Medicine
Division of General Internal Medicine and Ethics
Institute for Health Policy Studies
University of California, San Francisco

DaCosts R. Mason
Legal Counsel for the Elderly
District of Columbia Corporation Counsel

Alan Meisel
Professor of Law and Psychiatry
School of Law
University of Pittsburgh

Vijaya L. Melnick
Professor of Biology and Senior Research Scholar
Center for Research & Urban Policy
University of the District of Columbia

Paul Nathanson
Professor of Law, and
Director, Institute of Public Law
University of New Mexico

Cynthia E. Northrop
Attorney/Nurse

John J. Regan
Professor of Law
School of Law
Hofstra University

Marion Roach
Author

Randa Lee Smith
Coordinator, Diagnostic Service
Alzheimer Program
Casa Colina Hospital

David C. Thomasma
Director, Medical Humanities Program
Stritch School of Medicine
Loyola University Medical Center

Food and Renewable Resources Program

Technology, Public Policy, and the Changing Structure of American Agriculture Advisory Panel

Frank Baker
Director
International Stockmen's School
Winrock International Livestock
Research and Training Center

James Bonnen
Professor
Department of Agricultural Economics
Michigan State University

William Brown
Chairman of the Board
Pioneer Hi-Bred International, Inc.

Frederick Buttel
Associate Professor
Department of Rural Sociology
Cornell University

Willard Cochrane
Consultant

Jack Doyle
Director
Agricultural Resources Project
Environmental Policy Institute

Marsha Dudden
Dudden Farms, Inc.

Walter Ehrhardt
Blue Ridge Farms

Dean Gillette
Professor
Engineering Department
Harvey Mudd College

Rogert Granados
Executive Director
La Cooperativa

Richard Harwood
Director of Research
Rodale Research Center

Charles Kidd
Dean, College of Engineering Science,
Technology, and Agriculture
Florida A&M University

Robert Lanphier III
Chairman of the Board
Dickey-John Corp.

Edward Legates
Dean, College of the Agriculture and
Life Sciences
North Carolina State University

John Marvel
President and General Manager
Research Division
Monsanto Agriculture Products Co.

Donella Meadows
Adjunct Professor
Resources Policy Center
Dartmouth College

Don Paarlberg
Consultant

Don Reeves
Consultant
Interreligious Taskforce on U.S. Food
Policy

Milo Schanzenbach
Schanzenbach Farms

Workshop: Agricultural Structure and National Environmental Resources

Michael Boehlje
Professor
Department of Agricultural Economics
Iowa State University

James Cothern
Extension Economist
Department of Agricultural Economics
University of California, Davis

Lynn Forster
Associate Professor
Department of Agricultural Economics
and Rural Sociology
Ohio State University

Robert Fraley
Manager
Plant Molecular Biology Group
Monsanto Agriculture Products Co.

Charles Francis
Associate Director of Research
Rodale Research Center

Dellworth Gardner
Professor
Department of Agricultural Economics
University of California, Davis

William Hansel
Liberty Hyde Bailey Professor of
Animal Physiology
Department of Physiology
New York State College of Veterinary
Medicine
Cornell University

Harold Harris
Professor
Department of Agricultural Economics
Clemson University

Clyde Kiker
Associate Professor
Department of Food and Resource Economics
University of Florida, Gainesville

Randall Kramer
Department of Agricultural Economics
Virginia Polytechnic Institute

James Moore
Agricultural Engineering Department
Oregon State University

B.I. Osburn
Professor of Pathology and Associate Dean, Research
School of Veterinary Medicine
University of California, Davis

Allan Rahn
Associate Professor
Department of Animal Science
Michigan State University

Ford Runge
Assistant Professor
Department of Agricultural and Applied Economics
University of Minnesota

Lee Schrader
Professor
Department of Agricultural Economics
Purdue University

Ray Supalla
Associate Professor
Department of Agricultural Economics
University of Nebraska

Robert Todd
Department of Microbiology
South Dakota State University

Ronald Ward
Professor
Department of Food and Resource Economics
University of Florida, Gainesville

Workshop: Africa Tomorrow: Issues in Technology, Agriculture, and U.S. Foreign Aid

George Burrill
President
Associates in Rural Development

Charles Francis
Associate Director of Research
Rodale Research, Inc.

E. H. Gilbert
Director
Center for Research on Economic Development
University of Michigan, Ann Arbor

Thomas Hayden
Director, Social Concerns Department
Society of African Missions

James Henson
Director
International Programs Development
Washington State University

Marilyn Hoskins
Department of Sociology
Virginia Polytechnic Institute

Shelly Kessler
Consultant
Urban Resource Systems, Inc.

Carl Lindblad
Agricultural Post-Harvest Technical Specialist
Volunteers in Technical Assistance

Sauveur Mahotiere
Department of Horticulture
Fort Valley State College

Gerald Matlock
Department of Soils, Water and Engineering
University of Arizona, Tucson

Robert McDowell
Department of Animal Science
Cornell University

Uzo Mokwunye
International Fertilizer Development Center

Anita Spring
Department of Anthropology
University of Florida, Gainesville

Technologies to Maintain Biological Diversity Advisory Panel

Kenneth Dahlberg, *Chair*
Department of Political Science
Western Michigan University

Stephen Brush
International Agricultural Development
University of California, Davis

Peter Carlson
Director
Crop Genetics International

Rita Colwell
Office of the Vice President for Academic Affairs
Central Administration
University of Maryland, Adelphi

Raymond Dasmann
Department of Environmental Studies
University of California, Santa Cruz

Clarence Dias
President
International Center for Law in Development

Donald Duvick
Vice President of Research
Pioneer Hi-Bred International

David Ehrenfeld
Department of Horticulture and Forestry
Cooks College
Rutgers University

Major Goodman
Department of Crop Science
North Carolina State University

Grenville Lucas
The Herbarium
Royal Botanic Gardens

Richard Norgaard
Department of Agricultural and Resource Economics
University of California, Berkeley

Robert Prescott-Allen
Partner
PADATA

Paul Risser
Chief
Illinois Natural History Survey

Oliver Ryder
Research Department
San Diego Zoo

Michael Soule
Adjunct Professor
School of Natural Resources
University of Michigan

John Sullivan
Vice President of Production
American Breeders Service

Workshop: Values

Gardner M. Brown, Jr.
Acting Chairman
Department of Economics
University of Washington, Seattle

Malcolm F. McPherson
Research Associate
Harvard Institute for International Development
Harvard University

Margery L. Oldfield
Department of Zoology
University of Texas, Austin

Holmes Rolston III
Department of Philosophy
Colorado State University

Workshop: Plants

Jake Halliday
Director
Battelle-Kettering Research Laboratory

Robert Hanneman
Department of Horticulture
University of Wisconsin, Madison

Jack Koppenburg
Department of Rural Sociology
University of Wisconsin, Madison

Gary Nabhan
Office of Arid Land Studies
University of Arizona, Tucson

Thomas Orton
Applied Genetics Laboratory
Agrigenetics Corp.

Robert Stevenson
Director
American Type Culture Collection

Workshop: Natural Ecosystems—Domestic

Robert Jenkins
Vice President and Director of Science Programs
The Nature Conservancy

Bruce Jones
Bureau of Land Management
Phoenix Training Center

Orie Loucks
Holcomb Research Institute
Butler University

Hal Salwasser
Forest Service
U.S. Department of Agriculture

Dan Tarlock
Professor
Illinois Institute of Technology
Chicago Kent College of Law

Workshop: Natural Ecosystems—International

Raymond Dasmann
Department of Environmental Studies
University of California, Santa Cruz

Barbara Lausche
International Law Center
University of Colorado, Boulder

Gene Namkoong
Department of Genetics
North Carolina State University

Kathy Parker
Social Ecologist/Senior Technical Advisor
U.S. Agency for International Development

Daniel Simberloff
Department of Zoology
Florida State University

Workshop: Grass Roots

George Fell
Director
Natural Lands Institute

Elizabeth Henson
Director
Rare Breeds Rescue Project
American Minor Breeds Conservancy

Hans Neuhauser
Coastal Director
The Georgia Conservancy, Inc.

Edward Schmitt
Assistant Director
Animal Collections
Chicago Zoological Society

Jonathan A. Shaw
Director
Bok Towers Gardens

Kent Wheally
Director
Seed Savers Exchange

Workshop: Animals

Betsy Dresser
Director of Research
Cincinnati Wildlife

Warren Foote
International Sheep and Goat Institute
Utah State University

Keith Gregory
U.S. Meat Animal Research Center
USDA/ARS

David Notter
Department of Animal Science
Virginia Polytechnic Institute

Dale Schwindaman
Veterinary Services
USDA/APHIS

Ulysses Seal
Career Research Scientist
VA Medical Center

Workshop: Technologies to Benefit Agriculture and Wildlife

Norman A. Berg
Washington Representative
Soil Conservation Society of America

Steve Brady
State Biologist
Soil Conservation Service, Illinois

William Cooper
Department of Zoology
Michigan State University

Raymond D. Evans
Wildlife Division
Missouri Department of Conservation

Ed Frank
Wildlife Specialist
Wisconsin Department of Natural Resources

Tim Goodger
Oxford Laboratory
National Marine Fisheries Service

Larry Harris
Professor of Landscape Ecology
University of Florida, Gainesville

Larry Jahn
Vice President
Wildlife Management Institute

Jay Leitch
Department of Agricultural Economics
North Dakota State University

Raymond Linder
South Dakota Cooperative Unit Leader
Department of Fisheries and Wildlife
South Dakota State University

Chris Maser
Research Wildlife Biologist
Forestry Sciences Lab

Thom McEvoy
Aikens Center
School of Natural Resources
University of Vermont, Burlington

Robert I. Papendick
Soil Scientist and Research Leader
Science and Education Administration
U.S. Department of Agriculture

Randy Rodgers
Small Game Research Biologist
Kansas Fish and Game Commission

Integrated Renewable Resources Management for U.S. Insular Areas Advisory Panel

Fernando Abruna
Soil Scientist (retired)
Puerto Rico

John S. Corbin
Manager
Aquaculture Development Program
Hawaii Department of Land and Natural Resources

Eric Dillingham
Farmer
U.S. Virgin Islands

Lucius G. Eldredge
University of Guam Marine Laboratory

Sam Falanruw
Director
Department of Resources and Development
Yap State Government

Michael J. Gawel
Chief of Marine Resources
Federated States of Micronesia

Michael Hamnett
Research Coordinator
Pacific Islands Development Program

Stanley Hosie
Grassroots Specialist
Foundation for the Peoples of the South Pacific

Carolyn Imamura
Director
Planning and Programs
Pacific Basin Development Council

Robert E. Johannes
Division of Fisheries Research
CSIRP Marine Laboratories

Shelley M. Mark
Professor
Department of Agriculture and Resource Economics
University of Hawaii, Manoa

John Matuszak
Virgin Islands Cooperative Extension Service
College of the Virgin Islands

Jerome McElroy
Department of Business Administration and Economics
Saint Mary's College

Dieter Mueller-Dombois
Department of Botany
University of Hawaii, Honolulu

Robert Owen
Chief Conservation Officer (retired)
Trust Territory of the Pacific Islands

Maria T. Pangelinan
General Manager
Saipan Farmers Cooperative Association

Frank Peterson
Department of Geology and Geophysics
University of Hawaii, Honolulu

Allen Putney
Eastern Caribbean Natural Areas Management Program
West Indies Lab

Ralph Schmidt
Forest Service Chief
Puerto Rico Department of Natural Resources

Ace Tago
Pacific Management and Research Associate

Edward Towle
Director
Island Resources Foundation

Patrick Williams
Commissioner of Agriculture
U.S. Virgin Islands

Adrian Winkel
U.S. Territory Policy

Health Program

Health Program Advisory Committee

Sidney S. Lee, *Chair*
President
Milbank Memorial Fund

H. David Banta
Project Director
STG Project on Future Health Technology
The Netherlands

Rashi Fein
Professor, Department of Social Medicine and Health Policy
Harvard Medical School

Harvey V. Fineberg
Dean, School of Public Health
Harvard University

Patricia King
Professor
Georgetown Law Center

Joyce C. Lashof
Dean, School of Public Health
University of California, Berkeley

Alexander Leaf
Professor of Medicine
Harvard Medical School
Massachusetts General Hospital

Frederick Mosteller
Professor and Chair
Department of Health Policy and Management
School of Public Health
Harvard University

Norton Nelson
Professor, Department of Environmental Medicine
Medical School
New York University

Robert Oseasohn
Associate Dean
Health Science Center
University of Texas, San Antonio

Nora Piore
Senior Fellow and Advisor
Advisor to the President
United Hospital Fund of New York

Dorothy P. Rice
Regents Lecturer
Department of Social and Behavioral Sciences
School of Nursing
University of California, San Francisco

Richard K. Riegelman
Associate Professor of Medicine and Health Care Sciences
George Washington University School of Medicine

Walter L. Robb
Vice President and General Manager
Medical Systems Operations
General Electric

Frederick C. Robbins
Professor
Department of Epidemiology and Biostatistics
Case Western Reserve University

Frank Samuel
President
Health Industry Manufacturers Association

Rosemary Stevens
Professor
Department of History and Sociology of Science
University of Pennsylvania

Federal Policies and the Medical Devices Industry

Richard R. Nelson, *Chair*
Director and Professor
Institute for Social and Political Studies
Yale University

William F. Ballhaus
President
International Numatics, Inc.

Ruth Farrisey
Independent Consultant and Researcher

Peter Barton Hutt
Partner
Covington & Burling

Alan R. Kahn
Consultant

Grace Kraft
Board of Directors
Kidney Foundation of the Upper Midwest

Joyce C. Lashof
Dean, School of Public Health
University of California, Berkeley

Penn Lupovich
Director of Laboratories
Group Health Association

Victor McCoy
National Service Director
Paralyzed Veterans of America

Robert M. Moliter
Manager
Medical Systems Division
General Electric

Louise B. Russell
Senior Fellow
The Brookings Institution

Earl J. Saltzgiver
President
Foremost Contact Lens Service, Inc.

Allan R. Thieme
President
Amigo Sales Inc.

Eric von Hippel
Associate Professor of Management
Sloan School
Massachusetts Institute of Technology

Edwin C. Whitehead
Chairman
Technicon Corp.

Preventing Illness and Injury in the Workplace Advisory Panel

Morton Corn, *Chair*
Professor, Department of Environmental Health Sciences
School of Hygiene and Public Health
The Johns Hopkins University

Duane L. Block
Medical Director
Ford Motor Co.

Richard F. Boggs
Vice President
Organization Resources Counselors, Inc.

Mark R. Cullen
Professor of Statistics
Occupational Medicine Program
School of Medicine
Yale University

Philip E. Enterline
Professor of Biostatistics
School of Public Health
University of Pittsburgh

Melvin W. First
Professor
Department of Environmental Health Sciences
School of Public Health
Harvard University

Matt Gillen
Industrial Hygienist
Amalgamated Clothing and Textile Workers Union

Melvin Glasser
Director
Health Security Action Council

William J. McCarville
Director, Environmental Affairs
Monsanto Co.

Wilbur L. Meier, Jr.
Dean, School of Engineering
Pennsylvania State University

Samuel Milham, Jr.
Section Head, Epidemiology Section
Washington State Department of Social and Health Services

Kenneth B. Miller
Consultant
Occupational Medicine

Ted E. Potter
Environmental Manager
Shepherd Chemical Co.

Milan Racic
Director, Safety and Health
Allied Industrial Workers Union

Mark A. Rothstein
Associate Professor
West Virginia University College of Law

Marilyn Schule
Principal
Centaur Associates

Michael O. Varner
Corporate Manager
Department of Environmental Sciences
American Smelting & Refining Co.

James L. Weeks
Industrial Hygienist
United Mineworkers of America

Roger H. Wingate
Executive Vice President (retired)
Liberty Mutual Insurance Co.

Consultant to the Panel:
John Mendeloff
Associate Professor
Program in Science, Technology, and Public Affairs
University of California, San Diego

Agent Orange Study Protocol Review Advisory Panel

Richard Remington, *Chair*
Vice President for Academic Affairs
University of Iowa

Margit Bleecker
Assistant Professor
Division of Occupational Medicine
School of Hygiene and Public Health
The Johns Hopkins Medical Institutes

George L. Carlo
Epidemiologist
George Carlo & Associates

Neal Castagnoli, Jr.
Professor, Department of Chemistry and Pharmaceutical Chemistry
University of California, San Francisco

Theodore Colton
Professor
School of Public Health
Boston University

William Eaton
Associate Professor
Department of Mental Hygiene
Johns Hopkins University

Frederic Halbert
Delton, MI

George B. Hutchison
Professor
School of Public Health
Harvard University

Patricia King
Professor
Georgetown Law Center

Lewis Kuller
Professor
Department of Epidemiology
Graduate School of Public Health
University of Pittsburgh

Claire O. Leonard
Assistant Professor
Department of Pediatrics
University of Utah and Primary Children's Medical Center

Robert O'Toole
Appeals Consultant
Veterans of Foreign Wars of the United States

John F. Sommer, Jr.
Assistant Director
National Veterans Affairs and Rehabilitation Commission
The American Legion

John F. Terzano
National Membership Director
Vietnam Veterans of America

H. Michael D. Utidjian
Corporate Medical Director
American Cyanamid Co.

Blood Policy and Technology

Louanne Kennedy, *Chair*
Associate Professor
Department of Health Care Administration
Mt. Sinai School of Medicine

Alvin W. Drake
Professor of Systems Science and Electrical Engineering
Operations Research Center
Massachusetts Institute of Technology

Thomas C. Drees
President
Alpha Therapeutic Corp.

Tibor J. Greenwalt
Director
Paul I. Hoxworth Blood Center
University of Cincinnati Medical Center

Sylvia Drew Ivie
Director
National Health Law Program

Aaron Kellner
President
New York Blood Center

Sidney S. Lee
President
Milbank Memorial Fund

James W. Mosley
Acute Communicable Disease Control Section
Department of Health Services
Los Angeles County

Sharon Perkins
Coordinator, Donor Program
Fairfax Hospital, VA

Michael B. Rodell
Vice President
Regulatory and Technical Affairs
Ethical Products Division
Revlon Health Care Group

Rosemary Stevens
Professor
Department of History and Sociology of Science
University of Pennsylvania

Scott N. Swisher
President's Council
American Red Cross
National Headquarters

Martin J. Valaske
Medical Director
Medical Faculty Associates
George Washington University Medical Center

William D. White
Associate Professor
Department of Economics
University of Illinois, Chicago

Theodore Zimmerman
Professor, Department of Immunology
Department of Basic and Clinical Research
Scripps Clinic and Research Foundation

Wolf Zuelzer
Executive Director
National Hemophilia Foundation

Status of Biomedical Research and Related Technology for Tropical Diseases Advisory Panel

Pedro Acha
Director of Programming and Operations Coordination
Pan American Health Organization

George Alleyne
Chief
Research Promotion and Coordination
Pan American Health Organization

Karen Bell
Professional Associate
Board on Science and Technology for International Development
National Academy of Sciences

William Campbell
Senior Director
Basic Parasitology
Merck, Sharpe, & Dohme

Richard Cash
Director
Office of International Health
Harvard School of Public Health

Barnett Cline
Professor and Chairman
Department of Tropical Medicine
Tulane Medical Center

Joseph Cook
Program Director
Tropical Disease Research
The Edna McConnell Clark Foundation

Robert Goodland
Ecologist
Office of Environmental Affairs
World Bank

Abraham Horowitz
Director Emeritus and Special Consultant
Pan American Health Organization

Dieter Koch-Weser
Chairman, Department of Preventive and Social Medicine
Harvard Medical School

Francisco Lopez-Antunano
Coordinator
Tropical Disease Programme
Pan American Health Organization

Arnold Monto
Professor, Department of Epidemiology
School of Public Health
University of Michigan

Ruth Nussenzweig
Division of Parasitology
New York University School of Medicine

Richard Riegelman
Associate Professor
Department of Health Care Sciences
The George Washington University Medical Center

Gabriel Schmunis
Medical Officer
Tropical Diseases Programme
Pan American Health Organization

Thomas Simpson
Director
Eastern Shore Health District
Accomack County Health Department

Ronald Vogel
Associate Professor
Department of Management and Policy
College of Business and Public Administration
University of Arizona

Kenneth Warren
Director of Health Sciences
The Rockefeller Foundation

Medicare's Prospective Payment System: Strategies for Evaluating Cost, Quality, and Medical Technology Advisory Panel

John Eisenberg, *Chair*
Associate Professor of Medicine
University of Pennsylvania

John R. Ball
Associate Executive Vice President for Health and Public Policy
American College of Physicians

Morris Collen
Consultant
Department of Medical Methods Research
Kaiser-Permanente Medical Program

Helen Darling
Director, Human Research Studies
Government Research Corp.

Judith Feder
Co-Director
Center for Health Policy Studies
Georgetown University

Susan B. Foote
Assistant Professor
School of Business Administration
University of California, Berkeley

Anthony Gigliotti
Executive Vice President
United Hospital, Inc.

Melvin Glasser
Director
Health Security Action Council

Henry Grabowski
Professor, Department of Economics
Duke University

Mark Hornbrook
Senior Investigator
Health Services Research Center
Kaiser-Permanente Health Care Program

Ronald Hurst
Manager, Health Care Planning
Caterpillar Tractor

Judith Lave
Professor, Department of Health Economics
University of Pittsburgh

Barbara J. McNeil
Professor, Department of Radiology
Harvard Medical School

Heather Palmer
Assistant Professor
Health Policy and Management
Harvard School of Public Health

William Rial
Consultant

Richard Riegelman
Associate Professor of Medicine and Health Care Sciences
George Washington University School of Medicine

Leonard Saxe
Associate Professor
Department of Psychology
Boston University

Stephen Shortell
Professor of Hospital and Health Services Management and Organization Behavior
J. L. Kellogg Graduate School of Management
Northwestern University

Donald Sutherland
Director
Clinical and Instrument Systems
E. I. du Pont de Nemours & Co.

Bruce Vladeck
President
United Hospital Fund of New York

John E. Wennberg
Professor, Department of Community and Family Medicine
Dartmouth Medical School

James Young
Vice President and Medical Director
Blue Cross/Blue Shield of Massachusetts

Prospective Payment Assessment Commission Review Panel

Connie Evashwick
Director, Long-Term Care
Pacific Health Resources

Joanne Glisson
Legislative Representative
Kaiser-Permanente

Spencer Johnson
President
Michigan Hospital Association

Sidney S. Lee
President
Milbank Memorial Fund

Frederick C. Robbins
President
Institute of Medicine

Albert P. Williams
Director, Health Sciences Program
The Rand Corp.

Wanda Young
Vice President of Health Care Research
Blue Cross of Western Pennsylvania

Physician Payment and Medical Technology Under the Medicare Program Advisory Panel

Sidney Lee, *Chair*
President
Milbank Memorial Fund

John Ball
Associate Executive Vice President
American College of Physicians

Thomas Beauchamp
Professor of Philosophy and Senior Research Scholar
Kennedy Institute of Ethics
Georgetown University

Karen Davis
Chair, Department of Health Policy and Management
School of Hygiene and Public Health
Johns Hopkins University

Richard C. Dever
Vice President for Medical Affairs and Medical Officer
Blue Cross/Blue Shield of Florida

Joseph Eichenholz
Assistant Vice President, CIGNA
Affiliated Businesses Group

Peter Fox
Vice President
Lewin & Associates

Jack Hadley
Co-Director
Center for Health Policy Studies
Georgetown University

Ronald E. Henderson
Physician
Private practice

Jack Meyer
Director for Health Policy Studies
American Enterprise Institute

Janet Mitchell
Vice President
Health Economics Research

Vita R. Ostrander
President
American Association of Retired Persons

Thomas Pyle
President and Chief Executive Officer
Harvard Community Health Plan

Uwe Reinhardt
Professor, Department of Economics
Princeton University

C. Burns Roehrig
President
American Society for Internal Medicine

Jerald Schenken
President
Pathology Center
Omaha, NE

Steven Schroeder
Professor of Medicine
University of California, San Francisco

Jack Shelton
Manager, Employee's Insurance Department
Ford Motor Co.

Robert H. Taylor
Executive Committee, Board of Directors
American Academy of Family Physicians

B. Elizabeth Tunney
Director, Legislation
Retail, Wholesale, and Department Store Union, International

Sankey Williams
Associate Professor
Section of General Medicine
Hospital of the University of Pennsylvania

Workshop: Administrative Feasibility

Sidney Lee, *Chair*
President
Milbank Memorial Fund

Charles R. Booth
Director
Office of Reimbursement Policy
Health Care Financing Administration

Merwyn Greenlick
Vice President, Research
Kaiser Foundation Hospitals

Lisa Iezzoni
Health Care Research Unit
Boston University Medical Center

Stephen Isaacson
Senior Health Care Program Specialist
Policy Division
OCHAMPUS

Ronal M. Klar
Analyst
Health Services Analysis, Inc.

Arthur Lifson
Vice President
Equitable Life Assurance Society of America

Chris McEntee
Legislative Representative
Federal Affairs
American Association of Retired Persons

Helen Oglesby
Assistant Vice President
Director of Operations Support
Blue Shield of California

Christie Sommers
Director, Health Services Alternative Delivery System Development
John Hancock Insurance Co.

Carol Walton
Director, Office of Program Operations and Procedures
Health Care Financing Administration

Howard West
Project Director
Mandex, Inc.

Workshop: Data Processing

David Juba
Research Associate
Urban Institute

Kenneth Manton
Associate Professor
Center for Demographic Studies
Duke University

Peter McMenamin
Health Economist

Jack Meyer
Director of Health Policy Studies
American Enterprise Institute

James Vertrees
Senior Economist
La Jolla Management Corp.

Howard West
Project Director
Mandex, Inc.

Technology and Indian Health Care: Effectiveness, Access, and Efficiency Advisory Panel

James A. Crouch
Director
Bureau of Rural Health Services
Utah Department of Health

Ada Deer
Lecturer
School of Social Work and Office of Native American Programs
University of Wisconsin, Madison

Ronald G. Faich
Demographer
The Navajo Tribe

Rashi Fein
Professor
Department of Social Medicine and Health Policy
Harvard Medical School

Joel Frank
Executive Administrator and Vice President
United South and Eastern Tribes, Inc.

Forrest J. Gerard
President
Gerard, Byler & Associates

Ray Goetting
Member
Caddo Tribe of Oklahoma

Mario Gutierrez
Executive Director
California Rural Indian Health Board

Gerald Hill
VA Medical Center
San Francisco, CA

Violet Hillaire
Member
Lummi Tribe

Emory Johnson
Assistant Surgeon General (retired)
U.S. Public Health Service

Patricia King
Professor
Georgetown Law Center

Irving J. Lewis
Professor of Public Policy and Community Health
Department of Epidemiology and Social Medicine
Albert Einstein College of Medicine

Ethel Lund
President
Southeast Alaska Regional Health Corp.

Clark Marquart
Physician
Rosebud P.H.S. Hospital

Robert Oseasohn
Associate Dean
School of Public Health
University of Texas, San Antonio

Norine Smith
Director
Indian Health Board, Inc.

Ted Zuern
Associate Director
National Office
Jesuit Social Ministries

Technologies for Detecting Heritable Mutations Advisory Panel

Arno Motulsky, *Chair*
Professor of Medicine and Genetics
Director
Center for Inherited Diseases
University of Washington

Richard J. Albertini
Professor
College of Medicine
University of Vermont, Burlington

Michael Baram
Professor
Boston University School of Medicine and Public Health

Charles R. Cantor
Professor and Chair
Department of Human Genetics and Development
College of Physicians and Surgeons
Columbia University

Dale Hattis
Principal Research Associate
Center for Policy Alternatives
Massachusetts Institute of Technology

Ernest B. Hook
Chief
Chromosome Registry—Birth Defects Section
Bureau of Maternal and Child Health
New York State Department of Health

Alfred Knudson
Senior Member
Institute for Cancer Research
Fox Chase Cancer Center

Nan Laird
Associate Professor
Department of Biostatistics
School of Public Health
Harvard University

Mortimer L. Mendelsohn
Associate Director for Biomedical and Environmental Research Programs
Biomedical Sciences Division
Lawrence Livermore National Laboratory

Richard Meyers
Post Doctorate Fellow
Department of Biochemistry and Molecular Biology
Harvard University

Jeffrey Miller
Professor
Department of Biology
University of California, Los Angeles

James V. Neel
Lee R. Dice University Professor of Human Genetics
Department of Human Genetics
University of Michigan Medical School

Norton Nelson
Professor
Department of Environmental Medicine
New York University Medical School

Mark Pearson
Assistant Director of Molecular Biology
Central Research and Development Department
E.I. duPont de Nemours & Co.

Richard K. Riegelman
Associate Professor
Department of Medicine
George Washington University School of Medicine

Lianne B. Russell
Section Head
Biology Department
Oak Ridge National Laboratory

Richard B. Setlow
Chair
Biology Department
Brookhaven Laboratory

William J. Shull
Director and Professor
Center for Demographic and Population Genetics
Graduate School of Biomedical Sciences
The University of Texas Health Sciences Center

William Thilly
Professor
Genetic Toxicology Group
Massachusetts Institute of Technology

Smoking Related Deaths and Financial Costs Working Group

Sidney Lee, *Chair*
President
Milbank Memorial Fund

Robert Garrison
Statistician
National Heart, Lung, and Blood Institute

Thomas Glenn
Analyst
National Cancer Institute

Millicent Higgins
Epidemiologist
National Heart, Lung, and Blood Institute

Thomas Hodgson
Economist
National Center for Health Statistics

Eugene Lewitt
Director
Office of Primary Health Care Education
University of Medicine and Dentistry of New Jersey

Jay Lubin
Biostatistics Branch
National Cancer Institute

Gerry Oster
Senior Economist
Policy Analysis, Inc.

John Pinney
Institute for the Study of Smoking Behavior and Policy
Harvard University

Earl Pollack
Pollack Associates, Ltd.

R. P. Ravenholt
Director
Division of Drugs and Biologic Experience
World Health Surveys, Inc.

Harry Rosenberg
Director
Mortality Division
National Center for Health Statistics

Herbert Seidman
Assistant Vice President for Epidemiology and Research
American Cancer Society

Donald Shopland
Director
Office of Smoking and Health

James Shultz
Analyst
Minnesota Department of Health

Kenneth Warner
Professor
School of Public Health
University of Michigan

Mental Health Services for Children Working Group

Lenore Behar
Chief of Child Mental Health Services
Division of Mental Health, Mental Retardation, and Substance Abuse Services
North Carolina Department of Human Resources

Mark Blotcky
Physician
Timberlawn Hospital

Dennis D. Drotar
Psychologist
Rainbow Babies and Childrens Hospital

Susan K. Goldstein
Licensed Clinical Social Worker
Department of Child and Family Psychiatry
Group Health Association

Erv Janssen
Director, Children's Division
Menninger Foundation

Hubert E. Jones
Dean, School of Social Work
Boston University

Patricia King
Professor
Georgetown Law Center

Jane Knitzer
Fellow, The Bunting Institute
Radcliffe College

Gerald P. Koocher
Department of Psychiatry
Children's Hospital Medical Center

Judith Meyers
Associate Director
Bush Program in Child Development and Social Policy

Joseph J. Palombi
Family Counseling Center
Fairfax, VA

Patricia C. Pothier
Professor
School of Nursing
University of California, San Francisco

Jack Schonkoff
Department of Pediatrics
University of Massachusetts, Worcester

Carl E. Smith
Consultant, Behavioral Disorders
Iowa Department of Public Instruction

Jerry Weiner
Chairman
Department of Psychiatry
George Washington University Medical School

Edward Zigler
Department of Psychology
Yale University

Nurse Practitioners, Certified Nurse Midwives, and Physicians Assistants Working Group

Walter H. Caulfield
Vice President and Regional Administrator
Kaiser Permanente

Philip D. Cleveland
Director
Family Medicine Spokane

Lyn Etheredge
Senior Research Associate
Urban Institute

Willis Goldbeck
President
Washington Business Group on Health

Sandra Greene
Senior Director
Health Economics Research
Blue Cross/Blue Shield of North Carolina

Hurdis Griffith
Health Policy Consultant

Charles G. Huntington
General Partner
Hermon Medical Group

Lauren LeRoy
Assistant Director
Commonwealth Fund
Commission for the Elderly Living Along

Charles E. Lewis
Professor of Medicine, Public Health, and Nursing
Department of Medicine
University of California, Los Angeles

Michael R. Pollard
Director
Office of Policy Analysis
Pharmaceutical Manufacturers Association

Patricia A. Prescott
Associate Professor
School of Nursing
University of Maryland, Baltimore

Judith Rooks
Consultant

George M. Ryan
Acting Chairman
Department of Obstetrics and Gynecology
College of Medicine
University of Tennessee, Memphis

Richard M. Scheffler
Professor and Chair
Health Policy and Administration Program
School of Public Health
University of California, Berkeley

Henry M. Seidel
Associate Dean for Student Affairs
School of Medicine
The Johns Hopkins University

Gerry Shea
Director
Health Care Division
Service Employees International Union

Rosemary Stevens
Professor
Department of History and the Sociology of Science
University of Pennsylvania, Philadelphia

Barbara Warden
Executive Director
National Consumers' League

Ivan Williams
Scientific Director
Kellogg Center
Montreal General Hospital

SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION

Communication and Information Technologies Program

Information Technology Research and Development Advisory Panel

Roger G. Noll, *Chair*
Center for Advanced Studies in the Behavioral Sciences

Geneva Belford
Professor
Department of Computer Science
University of Illinois

Steven Bisset
President
Megatest, Inc.

John E. Bryson
President
California Public Utilities Commission

NandKishore Chitre
Director
Systems Planning Division
INTELSAT

Ralph E. Gomory
Vice President and Director of Research
Thomas J. Watson Research Center
IBM Corp.

John V. Harrington
Director
COMSAT Laboratories

William C. Hittinger
Executive Vice President
David Sarnoff Research Center
RCA Corp.

Bruce Lusignan
Director
Communication Satellite Planning Center
Stanford University

Donald McCoy
Vice President and General Manager
CBS Technology Center

Ithiel de Sola Pool
Professor of Political Science
Massachusetts Institute of Technology

Paul E. Ritt, Jr.
Vice President and Director of Research
GTE Laboratories, Inc.

Larry W. Sumney
Executive Director
Semiconductor Research Cooperative

Victor Vyssotsky
Executive Director
Research, Information Sciences
Bell Telephone Laboratories

Robert E. Wesslund
Vice President for Technology Exchange
Control Data Corp.

George R. White
Senior Research Fellow
The Harvard Business School

Workshop: Federal Research & Development

Charles Brownstein
Head
Information Sciences Division
National Science Foundation

Douglass Crombie
Chief Scientist
National Telecommunications and Information Administration

John A. Daly
Office of the Science Advisor
U.S. Agency for International Development

Craig Fields
Assistant Director for Systems Services
Defense Advanced Research Projects Agency

Clinton W. Kelly III
Assistant Director
Systems Science Division
Defense Advanced Research Projects Agency

Robert Lovell
Director of Communications
National Aeronautics and Space Administration

Robert S. Powers
Chief Scientist
Office of Science and Technology
Federal Communications Commission

John Riganati
System Components Division
National Bureau of Standards
U.S. Department of Commerce

Paul Schneck
Leader, Information Science Division
Office of Naval Research

Elias Schutzman
Program Director
Electrical Optical Communications Program
National Science Foundation

Workshop: Artificial Intelligence

Bruce Bullock
Vice President
Teknowledge Federal System

Marvin Denicoff
Executive
Thinking Machines Corp.

Ewald Heer
Program Manager
Autonomous Systems and Space Mechanics
Jet Propulsion Laboratory

Thomas F. Knight
Assistant Professor of Electrical Engineering and Computer Science
Artificial Intelligence Laboratory
Massachusetts Institute of Technology

Mitchell Marcus
Member of the Technical Staff
Linguistics and Artificial Intelligence Research Department
AT&T Bell Labs

Ronald Ohlander
Program Manager
Defense Advanced Research Projects Agency

Kamron Parsaye
President
Silogic, Inc.

Stephen Polit
Manager of Advanced Development
Artificial Intelligence Group
Digital Equipment Corp.

Azriel Rosenfeld
Director
Center for Automation Research
Computer Science Center
University of Maryland

David Waltz
Professor of Electrical Engineering and Research Professor
Coordinated Science Laboratory
University of Illinois

Patrick H. Winston
Professor of Computer Science and Engineering and Director
Artificial Intelligence Laboratory
Massachusetts Institute of Technology

Federal Government Information Technology: Key Trends and Policy Issues

Theodore J. Lowi, *Chair*
John L. Senior Professor of American Institutions
Cornell University

Arthur G. Anderson
Vice President (retired)
IBM Corp.

Jerry J. Berman
Legislative Counsel
American Civil Liberties Union

R. J. Bogumil
Past President
IEEE Society on Social Implications of Technology

James W. Carey
Dean, College of Communications
University of Illinois, Urbana

Melvin Day
Vice President
Research Publications

Joseph Duncan
Corporate Economist
The Dun & Bradstreet Corp.

William Dutton
Associate Professor of Communications and Public Administration
Annenberg School of Communications
University of Southern California

David H. Flaherty
Professor of History and Law
Privacy Project
University of Western Ontario

Carl Hammer
Consultant

Dale N. Hatfield
Dale N. Hatfield Associates

Starr Roxanne Hiltz
Professor of Sociology
Upsala College

John C. Lautsch
Chairman
Computer Law Division
American Bar Association

Edward F. Madigan
Information Services Division
Oklahoma Office of State Finance

Marilyn Gell Mason
Director
Atlanta Public Library

Joe Skinner
Corporate Vice President
Electronic Data Systems Corp.

Terril J. Steichen
President
New Perspective Group, Ltd.

George Trubow
Director, Center for Information Technology and Privacy Law
The John Marshall Law School

Susan Welch
Professor and Chairperson of Political Science Department
University of Nebraska, Lincoln

Alan F. Westin
Professor of Public Law and Government
Columbia University

Langdon Winner
Associate Professor of Politics
Department of Science and Technology Studies
Rensselaer Polytechnic Institute

Ex Officio:
Robert L. Chartrand
Senior Specialist
Congressional Research Service
Library of Congress

Ex Officio:
Robert D. Harris
Deputy Assistant Director for Budget Analysis
Congressional Budget Office

Ex Officio:
Kenneth W. Hunter
Senior Associate Director
Accounting and Financial Management Division
U.S. General Accounting Office

Workshop: Computer-Based Decision Support and Modeling

Rex Brown
Chairman of the Board
Decision Science Consortium, Inc.

Vincent Covello
Manager, Policy Sciences Section
National Science Foundation

Thomas Crowley
Director, Climate Dynamics Program
Atmospheric Sciences Division
National Science Foundation

Steve Frantzich
Department of Political Science
U.S. Naval Academy

Jim Hansen
Director
Goddard Institute of Space Studies
National Aeronautics and Space Administration

Alan Hecht
Director, National Climate Program
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Austin W. Kibler
Chief
Analytical Methods Research Division
Central Intelligence Agency

Frederick A. Koomanoff
Director, CO_2 Research Division
Office of Basic Energy Sciences
U.S. Department of Energy

Jerry D. Mahlman
Director
Geophysical Fluid Dynamics Laboratory
Princeton University

Miley Merkhofer
Principal
Applied Decision Analysis, Inc.

Michael Schlesinger
Atmospheric Sciences Department
Oregon State University

Jagadish Shukla
Director, Center for Ocean, Land, and Atmosphere Interaction
Department of Meteorology
University of Maryland

Martin Talcott
Senior Scientist
Decision Science Consortium, Inc.

Charles Treat
Director
Office of Program Planning and Evaluation
U.S. Department of Commerce

Warren Washington
Head, Climate Section
National Center for Atmospheric Research

Workshop: Information Security Policy

Louise Becker
Analyst
Computer Software and Engineering Division
Institute for Defense Analysis

Kier Boyd
Deputy Assistant Director
Technical Services Division
Federal Bureau of Investigation

Sheila Brand
DOD Computer Security Center

Joseph Coates
J. F. Coates, Inc.

Whitfield Diffie
Manager, Secure Systems Research
Bell Northern Research

Gene Epperly
Security Plans and Programs Director
Office of the Deputy Undersecretary of Defense (Policy)

John Ferris
Office of Systems Security and Certification
U.S. Department of the Treasury

Dave Geneson
Assistant Attorney General
U.S. Department of Justice

Richard Guilmette
Director, Corporate Security and Safety
Prime Computer Corp.

Gary Johnson
Office of Systems Security and Certification
U.S. Department of the Treasury

Stu Katzke
National Bureau of Standards
U.S. Department of Commerce

Stan Kurzban
Advisory Programmer
IBM Corp.

John Lane
Director of Information Systems
The Pentagon

Steve Lipner
Senior Engineering Manager, Secure Systems
Digital Equipment Corp.

Lynn McNulty
Information Systems Staff
U.S. Department of State

Robert Morris
Supervisor, Architecture and Performance Analysis Group
Bell Labs

Donn Parker
Senior Management Systems Consultant
Computer Security Programs
SRI

Marvin Schaefer
Chief Scientist
Computer Security Center
U.S. Department of Defense

Gail Shelton
Office of the Inspector General
U.S. Department of Health and Human Services

Miles Smid
Senior Mathematician
National Bureau of Standards
U.S. Department of Commerce

Richard Solomon
Research Program on Communications Policy
Massachusetts Institute of Technology

Ed Springer
Office of Information Regulatory Affairs
Office of Management and Budget

Stephen Walker
President
Trusted Information Systems, Inc.

Workshop: Information Technology Management, Planning and Procurement

Walter Anderson
Senior Associate Director
U.S. General Accounting Office

Frank Carr
Assistant Administrator for Information Resources Management
General Services Administration

Whit Dodson
Vice President and Director of Research
International Data Corp.

Forest Woody Horton, Jr.
Information Consultant

John Leslie King
Vice President
Irvine Research Corp.

Kenneth L. Kraemer
President
Irvine Research Corp.

Donald A. Marchand
Director
Institute of Information Management, Technology, and Policy
College of Business Administration
University of South Carolina

Frank McDonough
Deputy Assistant Administrator
General Services Administration

John McNicholas
Chief
Information Policy Branch
Office of Management and Budget

James Pivonka
Planning Officer
Internal Revenue Service

Harry Pontius
Team Leader
Information Technology Group
U.S. Department of Defense

Joseph Skinner
Corporate Vice president
Electronic Data Systems Corp.

Robert Woods
Manager, Automation Division
Office of Management Systems
Federal Aviation Administration

Intellectual Property Rights in an Age of Electronics and Information Advisory Panel

Paul Goldstein, *Chair*
Professor of Law
Stanford University

Jon A. Baumgarten
Partner
Paskus, Gordon & Hyman

Charles Benton
President of the Board
Benton Foundation
Chairman, Public Media Inc.

Stanley Besen
Economist
The Rand Corp.

Stephen Breyer
Judge
U.S. Court of Appeals

Harlan Cleveland
Director, Hubert Humphrey Institute of Public Affairs
University of Minnesota, Minneapolis

Stan Cornyn
Senior Vice President
Warner Brother Records

Oswald H. Ganley
Professor and Executive Director
Program on Information Resources Policy
Harvard University

Gustave M. Hauser
Chairman and Chief Executive Officer
Hauser Communications, Inc.

Mitchell Kapor
President
Lotus Corp.

Robert Lekachman
Professor of Economics
Lehman College

William Lilley, III
Vice President for Corporate Affairs
CBS

George Minot
Senior Vice President
Compuserve, Inc.

Dorothy Nelkin
Professor of Sociology
Cornell University

James A. Nelson
State Librarian and Commissioner
Kentucky Department of Libraries and Archives

John Shattuck
Vice President for Government and Public Affairs
Harvard University

Ollie Smoot
Executive Vice President
Computer and Business Equipment Manufacturers Association

Patricia Sturdivant
Associate Superintendent
Houston Independent School District

Sherry Turkle
Associate Professor of Sociology
Massachusetts Institute of Technology

Jack Valenti
President
Motion Picture Association of America, Inc.

Vivian Weil
Senior Research Associate
Illinois Institute of Technology

Martha Williams
Professor of Information Science
University of Illinois

Workshop: Economics

Christopher Burns
Christopher Burns, Inc.

Curtis Priest
Center for Policy Alternatives
Massachusetts Institute of Technology

A. Alan Schmid
Professor
Department of Agricultural Economics
Michigan State University

Workshop: Impact of Information Technologies on the Creative Process

Theodore Bikel
President Emeritus
Actors Equity

Milton Glaser
Graphic Artist

Richard Green
Musician

James Hammerstein
Stage Director

Joyce Hankansson
President
Hankansson Associates

David McCune
President
The Proteus Group, Inc.

Ann-Byrd Platt
Writer

Frederick Pohl
Writer

Anna Sofaer
Indendent Film Producer and Artist

Bill Weems
Photographer

George David Weiss
President
The Songwriters Guild

Automation of America's Offices Advisory Panel

Henry C. Lucas, *Chair*
Chairman, Department of Computer Applications and Information Systems
Graduate School of Business
New York University

Charles E. Branscomb
Vice President, Telecommunications
Communication Products Division
IBM Corp.

Dennis Chamot
Assistant Director
Department of Professional Employees
AFL-CIO

Marvin Dainoff
Professor of Psychology
Miami University

Rosalyn L. Feldberg
Visiting Research Scholar
Henry A. Murray Research Center
Radcliffe College

Thomas G. Hermann
Chairman, Law Office Technology Committee
American Bar Association

Robert C. Hughes
Vice President and Group Manager
Business and Office Systems Marketing
Digital Equipment Corp.

Barbara B. Hutchison
Director, Women's Division
American Federation of Government Employees

Lois Martin
Vice President
The First National Bank of St. Paul

Karen Nussbaum
Executive Director
9 to 5: National Association of Working Women

Robert M. Peabody
Assistant Vice President and Director of Office Automation
Mutual of Omaha

Randy J. Pilc
Department Head
Product Family Services
AT&T Information Services

Robert Ellis Smith
Editor and Owner
Privacy Journal

Vernell K. Munson Sutherland
President
Knowledge Systems

Ralph E. Upton, Jr.
Director
St. Augustine Technical Center

Workshop: Supercomputers

Kent K. Curtis
Director
Division of Computer Research
National Science Foundation

James Decker
Acting Deputy Director
U.S. Department of Energy

Sidney Fernback
Consultant
Control Data Corp.

Robert Gillespie
Consultant
Gillespie Folkner & Associates

Paul Schneck
Director
Supercomputer Research Center
Institute for Defense Analysis

Jacob Schwartz
Director
Division of Computer Sciences
Courant Institute of Mathematical Sciences
New York University

Joe Wyatt
Chancellor
Vanderbilt University

Workshop: Societal Impacts of Artificial Intelligence

Hubert Dreyfus
Philosophy Department
University of California, Berkeley

Rob Kling
Professor
Information and Computer Science
University of California, Irvine

Walter Lowen
Department of Systems Science
University Center at Binghamton
State University of New York

Mitchell Marcus
Technical Staff
AT&T Bell Laboratories

Abbe Mowshowitz
Computer Sciences
City College
City University of New York

Nils J. Nilsson
Director
Artificial Intelligence Center
SRI International

John R. Searle
Department of Philosophy
University of California, Berkeley

Ben Shneiderman
Associate Professor, Computer Science
Human-Computer Interaction Laboratory
University of Maryland

John Snapper
Humanities Department
Illinois Institute of Technology

Nico Spinelli
Professor of Computer Science and Adjunct Professor of Psychology
Lederle Graduate Research Center
University of Massachusetts, Amherst

Sherry Turkle
Professor
Massachusetts Institute of Technology

David Waltz
Senior Specialist
Thinking Machines, Inc.

Charles Weiner
Professor of History of Science and Technology
Program in Science, Technology, and Society
Massachusetts Institute of Technology

Joseph Weizenbaum
Professor
Massachusetts Institute of Technology

Karen Wieckert
Systems Analyst
Systems Development Corp.

Langdon Winner
Associate Professor of Politics
Crown College
University of California

Oceans and Environment Program

Managing the Nation's Commercial High-Level Radioactive Waste Advisory Panel

Hans Frauenfelder, *Chair*
Professor, Department of Physics
University of Illinois

Seymour Abrahamson
Professor, Department of Zoology
University of Wisconsin

Frank Collins
Consultant

Floyd Culler
President
Electric Power Research Institute

J. William Futrell
President
Environmental Law Institute

Edward Goldberg
Professor of Geology
Scripps Institution of Oceanography
University of California

William W. Hambleton
Director
Kansas Geological Survey

Harriet Keyserling
Member
House of Representatives
State of South Carolina

Terry Lash
Deputy Director
Department of Nuclear Safety
State of Illinois

Kai Lee
Institute for Environmental Studies
University of Washington

Jeanne Malchon
State Senator
State of Florida

Peter Montague
Center for Environmental Studies
Princeton University

Glenn Paulson
Vice President for Science
National Audubon Society

Howard Raiffa
Frank P. Ramsey Professor of Managerial Economics
Harvard Business School

William A. Thomas
Consultant
American Bar Foundation

Mason Willrich
Vice President—Corporate Planning
Pacific Gas & Electric Co.

Donald Wodrich
Rockwell International-Hanford Operations

John Yasinsky
General Manager
Advanced Power Systems Divisions
Westinghouse Electric Corp.

Protecting the Nation's Groundwater From Contamination Advisory Panel

Thomas Maddock III, *Chair*
Professor
Department of Hydrology and Water Resources
University of Arizona

Harvey Banks
Consulting Engineers, Inc.

Rodney Dehan
Administrator
Groundwater Program
Florida Department of Environmental Regulation

Robert Harris
Professor
Center for Energy and Environmental Studies
Princeton University

Allen V. Kneese
Senior Fellow
Resources for the Future

Jay H. Lehr
Executive Director
National Well Water Association

Perry McCarty
Chairman
Department of Civil Engineering
Stanford University

James Mercer
President
GeoTrans, Inc.

David W. Miller
President
Geraghty & Miller, Inc.

Marylou Munts
State Representative
Wisconsin

Michale A. Pierle
Director
Regulatory Management—Water
Monsanto Co.

Anthony Z. Roisman
Executive Director
Trial Lawyers for Public Justice

Lawrence Swanson
Director
Great Plains Office of Policy Studies
University of Nebraska

James T. B. Tripp
Counsel
Environmental Defense Fund

Oil and Gas Technologies in the Arctic and Deepwater Advisory Panel

John H. Steele, *Chair*
Director
Woods Hole Oceanographic Institute

Jacob Adams
President
Arctic Slope Regional Corp.

Lawrence N. Bell
Vice President
Arco Oil & Gas Co.

Charles L. Blackburn
Executive Vice President
Exploration and Development
Shell Oil Co.

Sarah Chasis
Senior Staff Attorney
Natural Resources Defense Council

Clifton E. Curtis
Executive Vice President
The Oceanic Society

Gordon Duffy
Secretary, Environmental Affairs
State of California

Walter R. Eckelmann
Senior Vice President
Sohio Petroleum Corp.

William Fisher
State Geologist
State of Texas

Robert Grogan
Associate Director for Governmental Coordination
Office of the Governor of Alaska

Frank J. Iarossi
President
Exxon Shipping Co.

Don E. Kash
Director
Science and Public Policy Program
University of Oklahoma

Dan R. Motyka
Vice President—Frontier
Gulf Canada Resources, Inc.

C. Robert Palmer
Board Chairman and President
Rowan Companies, Inc.

Stanley Stiansen
Vice President
American Bureau of Shipping

Wallace Tyner
Professor
Department of Agricultural Economics
Purdue University

Michael T. Welch
Vice President
Citibank, N.A.

Wastes in the Marine Environment: Their Management and Disposal Advisory Panel

Thomas Clingan, *Chair*
School of Law
University of Miami

William Bascom
Director
Southern California Coastal Water Research Project

Rita Colwell
Vice President for Academic Affairs
University of Maryland, College Park

A. Myrick Freeman III
Department of Economics
Bowdoin College

John Gosdin
Director of Natural Resources
Governor's Office, Texas

Zeke Grader
General Manager and Counsel
Pacific Coast Federation of Fishermen's Associations

John Hinck
National Toxics Coordinator
Greenpeace

Robert Hope
Director, Port of Mobile
Alabama State Docks Department

Kenneth Kamlet
Director, Pollution and Toxic Substances Division
National Wildlife Federation

John A. Knauss
Vice President, Marine Program
Graduate School of Oceanography
University of Rhode Island

William J. Marrazzo
Water Commissioner
City of Philadelphia

Joseph T. McGough, Jr.
Commissioner
New York City Department of Environmental Protection

Mike Norton
First Secretary (Science)
British Embassy

Jerry Schubel
Director
Marine Sciences Research Center
State University of New York at Stony Brook

Richard F. Schwer
Environmental Consultant
Dupont Engineering Department

Workshop: Subseabed Disposal

D. R. Anderson
Sandia Laboratories

Clifton Curtis
The Oceanic Society

Eric Hartwig
Office of Naval Research

Ross Heath
College of Ocean and Fishery Sciences
University of Washington, Seattle

John Matuszek
Wadsworth Center for Labs and Research

Gilbert Rowe
Oceanographic Sciences Division
Brookhaven National Laboratory

Glenn Sjoblom
Office of Air and Radiation
U.S. Environmental Protection Agency

Workshop: Dredged Material Disposal

Bill Conner
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

Bob Ender
United States Army Corps of Engineers

Dan Farrow
Ocean Assessing Division
National Oceanic and Atmosheric Administration
U.S. Department of Commerce

Tim Goodger
National Marine Fisheries Services
U.S. Department of Commerce

Frank L. Hamons
Maryland Port Administration

David Hankla
Fish and Wildlife Service
U.S. Department of the Interior

George Hanson
Fish and Wildlife Service
U.S. Department of the Interior

Jim Houston
United States Army Corps of Engineers

Bob Morton
Science Applications International Corp.

Tom O'Connor
Ocean Assessments Division
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

W. E. Pequegnat
Oceanographic Consultant

Ron Vann
Corps of Engineers
Norfolk District

Al Wastler
U.S. Environmental Protection Agency

Marine Applications of Fuel Cell Technologies Working Group

Gary Baham
Baham Corp.

Frank Critelli
Maritime Administration
U.S. Department of Transportation

Lloyd Fink
Maritime Administration
U.S. Department of Transportation

Paul Grevstad
International Fuel Cells Corp.

Gene Helms
Chief Project Engineer
Allison Gas Turbine Division
General Motors

Douglas Jewell
Morgantown Energy Technology Center

Johann Joebstl
Belvoir R&D Center
U.S. Army

Art Kaufman
Engelhard Corp.

William Kumm
Arctic Energies Ltd.

James E. Nivin
Vice President
American Commercial Barge Lines

Ted Stanford
Naval Sea Systems Command
U.S. Department of the Navy

Percival Wilson
Consultant

Joe Woener
Navy Ship R&D Center
Annapolis Laboratory

Richard R. Woods
Gas Research Institute

Science, Education, and Transportation Program

Civilian Space Stations Advisory Panel

Robert A. Charpie, *Chair*
President
Cabot Corp.

Harvey Brooks
Benjamin Peirce Professor of Technology and Public Policy
Harvard University

Peter O. Crisp
President
Venrock, Inc.

Freeman Dyson
Professor
Institute for Advanced Study

James B. Farley
Chairman of the Board
Booz-Allen & Hamilton, Inc.

Charles E. Fraser
Chairman
Sea Pines Co.

Andrew J. Goodpaster
President
Institute of Defense Analyses

Charles Hitch
The Lawrence-Berkeley Laboratory
University of California, Berkeley

Bernard M. W. Knox
Director (retired)
Center for Hellenic Studies

Moya Lear
Chairman of the Board
Lear Avia Corp.

George E. Mueller, Jr. (retired)
President and Chief Executive Officer
System Development Corp.

Carl Sagan
Director of the Laboratories for Planetary Studies
Cornell University

INTENTIONAL
BLANK

Eugene Skolnikoff
Director
Center for International Studies
Massachusetts Institute of Technology

James Spilker
President
Stanford Telecommunications Inc.

Frank Stanton
President Emeritus
CBS Inc.

James A. Van Allen
Head
Physics and Astronomy Department
University of Iowa

Transportation of Hazardous Materials Advisory Panel

John W. Barnum, *Chair*
Attorney
White & Case

Garnet Bernhardt
Colerain Township
Cincinnati, OH

Keith J. Bunting
Manager, Distribution
Dow Chemical Co.

Robert A. Christman
Director, Customer and Distribution Service
Mobay Chemical Corp.

Sherwood Chu
Associate Director for Regulatory Planning and Analysis
Materials Transportation Bureau
U.S. Department of Transportation

John Cooper
Manager of Waste and Transportation
Illinois Department of Nuclear Safety

Richard E. Cunningham
Director, Fuel Cycle and Material Safety Division
Nuclear Regulatory Commission

Ed Dietz
Manager of Barge Transportation
Union Carbide Corp.

Edward S. Ford
Senator
General Assembly
Commonwealth of Kentucky

Roger Kasperson
Center for Technology, Environment and Development
Clark University

Kevin Kenzenkovic
City Manager
Slater, MO

Charles N. Lovinski
Corporate Manager for Restricted Articles
Federal Express

Charles H. Mayer
Vice President, Nuclear and Hazardous Materials Division
Tri-State Motor Transit Co.

Warren Owen
Executive Vice President
Duke Power Co.

Paul Remick, Jr.
Distribution Advisor
Exxon USA

Cathy Reynolds
President, City Council
Denver, CO

Raymond D. Scanlon
Economic Development Department
The Port Authority of New York and New Jersey

William R. Teer
Vice President
Transnuclear, Inc.

A. D. Williams
Director of Energy and Environmental Programs Planning
Union Pacific Railroad

State and Local Workshop

Robert Robison, *Chair*
Radioactive Materials Emergency Coordinator
State of Oregon

John C. Allen
Principal Laboratory Scientist
Battelle Columbus Laboratories

Peter E. Baker
Hazardous Materials Transportation Unit
New Jersey State Police

Stanley Brand
Manager of Hazardous Materials and Operator for Emergency Response
Monsanto Co.

Juanita Crabb
Mayor
Binghamton, NY

L. Joe Deal
Acting Director
Radiological Assistance Controls Division
Office of Nuclear Safety
U.S. Department of Energy

Warren E. Isman
Chief
Fairfax County Fire and Rescue Department
Fairfax, VA

William Keffer
Chief, Emergency Planning and Response Branch
Region VII Environmental Protection Agency

George Kramer
Hazardous Materials Instructor
Tennessee Emergency Management Agency

Richard P. Landis
Associate Administrator for Motor Carriers
Federal Highway Administration
U.S. Department of Transportation

Donald Lewis
Rail and Motor Carrier Training Officer
Washington Utilities and Transportation Commission

Paul Melander, Jr.
Manager of Transportation Investigation
Tennessee Public Service Commission

Fred Millar
Director
Nuclear and Hazardous Materials Transportation Project
Environmental Policy Institute

William H. Nalley
Chief
Federal, State and Private Sector Initiatives
Research and Special Programs Administration
Office of Hazardous Materials Transportation
U.S. Department of Transportation

Richard O'Boyle
Safety Director
Quality Carriers, Inc.
Bristol Wisconsin Office

Susan Peres
Emergency Management Specialist
Technology Hazards Division
Federal Emergency Management Administration

Robert Philpot
Transportation Program Branch Chief
U.S. Department of Energy

Kenneth L. Pierson
Director
Bureau of Motor Carrier Safety
Federal Highway Administration
U.S. Department of Transportation

Dennis L. Price
Director
Safety Projects Office
Virginia Polytechnic Institute

Vallary Sandstrom
Acting Chief, Programs Liaison Branch
Research and Special Programs Administration
Office of Hazardsous Materials Transportation
U.S. Department of Transportation

Bruce Smith
Assistant Chief
Colerain Township Fire Department
Cincinnati, OH

Charles Wright
Training Officer
Union Pacific Railroad

Workshop: Nuclear Materials Packaging

Roger Kasperson, *Chair*
Center for Technology, Environment and Development
Clark University

George C. Allen Jr.
Supervisor, Transportation Systems Development and Testing Division
Transportation Technical Center
Sandia National Laboratories

Robert Anderson
Manager of Cask and Transportation Systems Engineering
Chem-Nuclear Systems, Inc.

Lindsay Audin
Mechanical Engineer
Goldman, Sokolov, Copeland, P.C.

Philip E. Eggers
Nuclear Consultant
Eggers, Ridihaigh Partners

Kurt Goldmann
Chief Engineer
Transnuclear, Inc.

John Van Hoomissen
Manager of High Level Radioactive Waste Services
General Electric Co.

Robert J. Hughes, Jr.
Vice President
James Hughes, Inc.

Dale Klein
Director of Nuclear Engineering Teaching Laboratory
University of Texas, Austin

Charles E. McDonald
Chief, Transportation Certification Branch
Office of Nuclear Material Safety and Safeguards
Nuclear Regulatory Commission

Heinz Mueller
Assistant Director
Hazardous Materials Section
Illinois State Police

Reuben W. Peterson
Chief Transportation Engineer
Battelle Columbus Laboratories

Richard R. Rawl
Chief, Radioactive Materials Branch
Office of Hazardous Materials Regulation
Material Transport Bureau
U.S. Department of Transportation

Paul Rhine
Manager, Train Energy Conservation, Energy and Environmental Programs
Union Pacific Railroad

Joseph Strohl
State Senator
Wisconsin State Senate

Thomas White
Member of the City Council
Greenbelt, MD

Edwin Wilmot
Transportation Specialist
Office of Civilian Radioactive Waste Management
U.S. Department of Energy

Workshop: Nonnuclear Containers

Lawrence W. Bierlein, *Chair*
President
Lawrence W. Bierlein, P.C.

B. J. Barrett
Director
Marketing and Sales
Chemical Leaman Container Corp.

Timothy Burbink
Manager, Hazardous Materials Activity
Consolidated Freightways

Robert D. Ervin
Assistant Head Engineer
Research Division
Highway Safety Research Institute
The University of Michigan

Max Fessler
Vice President for Sales
LPS Industries, Inc.

Joseph Fulnecky
Chief, Hazardous Materials Branch
Bureau of Motor Carrier Safety
Federal Highway Administration

Lawrence Gibson
Cargo and Hazards Branch
Office of Merchant Marine Safety
United States Coast Guard

William H. Gushard
Vice President
Greif Bros. Corp.

Darlene Walters Hunt
Senior Restricted Articles Specialist
Federal Express

Fred Krysel
Chief Engineer
Polar Tank Trailer

Robert M. McClanahan
Assistant Chief
County Fire and Rescue Division
Fairfax, VA

Thomas A. McKenna
Senior Supervisor
Materials & Logistics Department
E. I. du Pont de Nemours & Co.

Donald Monroe
Principal Surveyor
American Bureau of Shipping

James O'Steen
Chief, Engineering Branch
Materials Transportation Bureau
Office of Hazardous Materials Regulation
Research and Special Programs Administration
U.S. Department of Transportation

Earl A. Phillips
Vice President, Engineering Development
Union Tank Car Co.

Richard E. Phillips
Engineer for Transportation Equipment
Ethyl Corp.

Harlan Pierson
Member
Maine State Police

Edward W. Pritchard
Engineer, Maintenance Programs Division Safety Office
Federal Railroad Administration
U.S. Department of Transportation

Paul Seay
Chief of Engineering Branch (retired)
Office of Hazardous Materials Regulation
Materials Transportation Bureau
U.S. Department of Transportation

Patrick J. Student
Hazardous Materials and Environmental Protection
Missouri Pacific Railroad Co.

Robert L. Temper
Hazardous Materials Packaging
Mallinckrodt, Inc.

Workshop: Sister Congressional Agencies

James Blume
Issue Area Planning Director/Transportation
General Accounting Office

Daniel Carroll
Assistant Analyst
Natural Resources and Commerce
Congressional Budget Office

Edward Morahan
Evaluator
General Accounting Office

Vincent Price
Evaluator
General Accounting Office

Paul Rothberg
Specialist in Science and Technology
Science Policy Research Division
Congressional Research Service

Kenneth Rubin
Principal Analyst
National Resources and Commerce
Congressional Budget Office

Janie Wishart
Principal Analyst
Natural Resources and Commerce
Congressional Budget Office

Science Policy Workshop: Government Funding of Research as an Investment

Harvey Averch
Professor
Economics and Government Funding
University of Maryland

Henry Hertzfeld
Professor
Consultant in Economics and Legal Issues in Research and Development

J. David Roessner
Technology and Science Policy Program
Social Science Department
Georgia Institute of Technology

Nestor Terleckyj
Director
Center for Socio-Economic Analyses
National Planning Association

Science Policy Workshop: Demographic Trends and the Scientific and Engineering Work Force

Jerrier A. Haddad
Consultant
National Research Council

Lee Hansen
Professor
Department of Economics
University of Wisconsin, Madison

Lilli S. Hornig
Executive Director
Higher Education Resource Services
Wellesley College

Luther S. Williams
President
Atlanta University

Dael Wolfle
Professor
Graduate School of Public Affairs
University of Washington, Seattle

Science Policy Workshop: The Education and Employment of Scientists and Engineers

Susan Berryman
The Rand Corp.

Radford Byerly
Science Consultant
Committee on Science and Technology
U.S. House of Representatives

Lloyd Cooke
Consultant

Michael Crowley
Study Group Director
Division of Science Resource Studies
National Science Foundation

Charles Dickens
Director
Division of Science Resource Studies
National Science Foundation

Daniel Drucker
Graduate Research Professor
Department of Engineering Sciences
University of Florida

Alan Fechter
Executive Director
Office of Scientific and Engineering Personnel
National Research Council

Jerrier A. Haddad
Consultant

Maria Hardy
Louisiana State University

Allan Hoffman
Executive Director
Committee on Science, Engineering and Public Policy
National Academy of Sciences

John Holmfeld
Science Consultant
Committee on Science and Technology
U.S. House of Representatives

Lilli S. Hornig
Executive Director
Higher Education Resource Services
Wellesley College

Fred Landis
Dean of Engineering
University of Wisconsin

W. Edward Lear
Executive Director
American Society for Engineering Education

Henry Lowendorf
Consultant

Shirley Malcom
Office of Opportunities in Science
American Association for the Advancement of Science

Shirley McBay
Dean of Student Affairs
Massachusetts Institute of Technology

Michael McPherson
Senior Fellow
Brookings Institution

Denis F. Paul
Assistant Commissioner for Higher Education Academic Review
State Education Department
State of New York

Willie Pearson
Department of Sociology
Wake Forest University

Geraldine Richmond
Department of Chemistry
University of Oregon

Harrison Shull
Chancellor
University of Colorado

F. Karl Willenbrock
Professor of Engineering
School of Engineering and Applied Science
Southern Methodist University

Luther S. Williams
President
Atlanta University

Dael Wolfle
Professor
Graduate School of Public Affairs
University of Washington

Science Policy Workshop: Regulatory Environment for Science

Harvey Brooks, *Chair*
Benjamin Peirce Professor of Technology & Public Policy
Harvard University

Diana Dutton
Professor
Health Services Research
Stanford University School of Medicine

Harold P. Green
Associate Dean for Post J.D. Studies
The National Law Center
George Washington University

Clifford Grobstein
Professor
Biological Science and Public Policy
University of California, San Diego

Irving S. Johnson
Vice President of Research
Lilly Research Laboratories

Jonathan A. King
Professor of Molecular Biology
Massachusetts Institute of Technology

Alan McGowan
President
Scientists' Institute for Public Information

John Shattuck
Vice President of Government, Community and Public Affairs
Harvard University

Workshop #1: Automation and Robotics for the Space Station

Thomas Sheridan, *Chair*
Department of Mechanical Engineering
Massachusetts Institute of Technology

Richard Baxter
First Secretary, Technology
Embassy of the United Kingdom

Richard Carlisle
Space Station Program
NASA Headquarters

Frank Cevasco
Director, NATO Affairs
Office of the UnderSecretary of Defense for Research and Engineering

W.F. Cockburn
Science Counselor
Embassy of Canada

W.M. Evans
Director, Space Policy and Plans
Ministry of State for Science and Technology
Canada

Lyn Gordon-Winkler
Assistant for External Affairs
NASA Johnson Space Center

Helmut Hardegen
Deputy Director
Institute for Fiightguidance
DFVLR
Federal Republic of Germand

Max Holley
Technical Assistant
Systems Engineering and Integration Office
Space Station Program
NASA Johnson Space Center

Alan C. Holt
Space Station Customer Integration Office
NASA Johnson Space Center

Louis Laidet
Scientific Attache for Space Affairs
Embassy of France

Enzo Letico
Washington Office
PSN/CNR-Italian National Space Plan

Savi Sachdev
Manager, Systems Engineering
SPAR Aerospace Ltd., RMS Division
Canada

Workshop #2: Automation and Robotics for the Space Station

Thomas Sheridan, *Chair*
Professor
Department of Mechanical Engineering
Massachusetts Institute of Technology

James Albus
Chief
Industrial Systems Division
National Bureau of Standards

Dean Brown
President
Picodyne Corporation

Robert Canon
Chairman
Department of Aeronautics and Astronautics
Stanford University

Rodger Cliff
Chief Scientist
Defense Advanced Research Projects Agency

David Criswell
California Space Institute
University of California, San Diego

Jon Erickson
Manager
Artificial Intelligence and Information Sciences
NASA Johnson Space Center

Oscar Firschein
Staff Scientist
Artificial Intelligence Center
SRI International

Owen Garriott
Astronaut
Space Station Program Office
NASA Johnson Space Center

Dr. Edward Gibson
Space Station Program Manager
TRW

Max Ho[illegible]ey
Technical Assistant
Systems Engineering and Integration Office
NASA Johnson Space Center

Tomas Lozano-Perez
Artificial Intelligence Laboratory
Massachusetts Institute of Technology

Henry Lum
Chief
Information Sciences Office
NASA Ames Research Center

Ross Pepper
Research Scientist
Naval Oceans Systems Center

Charles Rosen
Chief Scientist
Machine Intelligence Corp.

Carl Ruoff
Member of Staff
Jet Propulsion Laboratory

Amy L. Toussaint
Specialist Engineer
Artificial Intelligence
Boeing Aerospace Corp.

Workshop: Strengths and Weaknesses of Standardized Tests: State by State Comparisons

John T. Guthrie
Director, Center for Educational Research and Development
College of Education
University of Maryland

Ronald K. Hambleton
School of Education
University of Massachusetts

Gary Phillips
Chief, Research Evaluation and Statistical Services
Office of Management Information Systems
Maryland State Department of Education

John P. Poggio
School of Education
University of Kansas

Ed Roeber
Supervisor, MEAP
Michigan Department of Education

Paul D. Sandifer
Director, Office of Research
State Department of Education
South Carolina

Workshop: Strengths and Weaknesses of Standardized Tests: Mathematics Review

Gordon Lewis
Mathematics Supervisor
Washington, DC, Public Schools

Alice Morgan-Brown
Divison of Secondary Education
Office of Mathematics
Baltimore Public Schools

Thomas J. Nuttall
Consultant

James Wilson
Department of Mathemtics Education
University of Georgia

Workshop: Strengths and Weaknesses of Standardized Tests: Reading Review

Peter Callahan
Consultant

Irwin Kirsch
Director of Adult Literacy
Princeton, NJ

Dorothy B. Nave
Director of Curriculum
Dorchester County Board of Education

Karen K. Wixson
Professor
School of Education
University of Michigan

Appendix C
OTA Act

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

86 STAT. 797

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessment Act of 1972".

Technology Assessment Act of 1972.

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. [illegible]. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

Technology Assessment Board.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

Duties.

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities;

(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and

(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:

(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;

(2) the Board; or

(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where—

(1) to do so would violate security statutes; or

(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 Stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

SEC. 4. (a) The Board shall consist of thirteen members as follows:

(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;

(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and

(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

Meetings.

Subpena.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

Compensation.

83 Stat. 863.

Sec. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

Employment restriction.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act.

AUTHORITY OF THE OFFICE

Sec. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—

(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

Contracts.

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory,

or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

80 Stat. 499; 83 Stat. 190.

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

Agency cooperation.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

Membership.

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall—

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

80 Stat. 498; 83 Stat. 190. 5 USC 5701.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing. 82 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156; 82 Stat. 365. 42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed *$5,000,000 in the aggregate for the two fiscal years* ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and
No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept.22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.